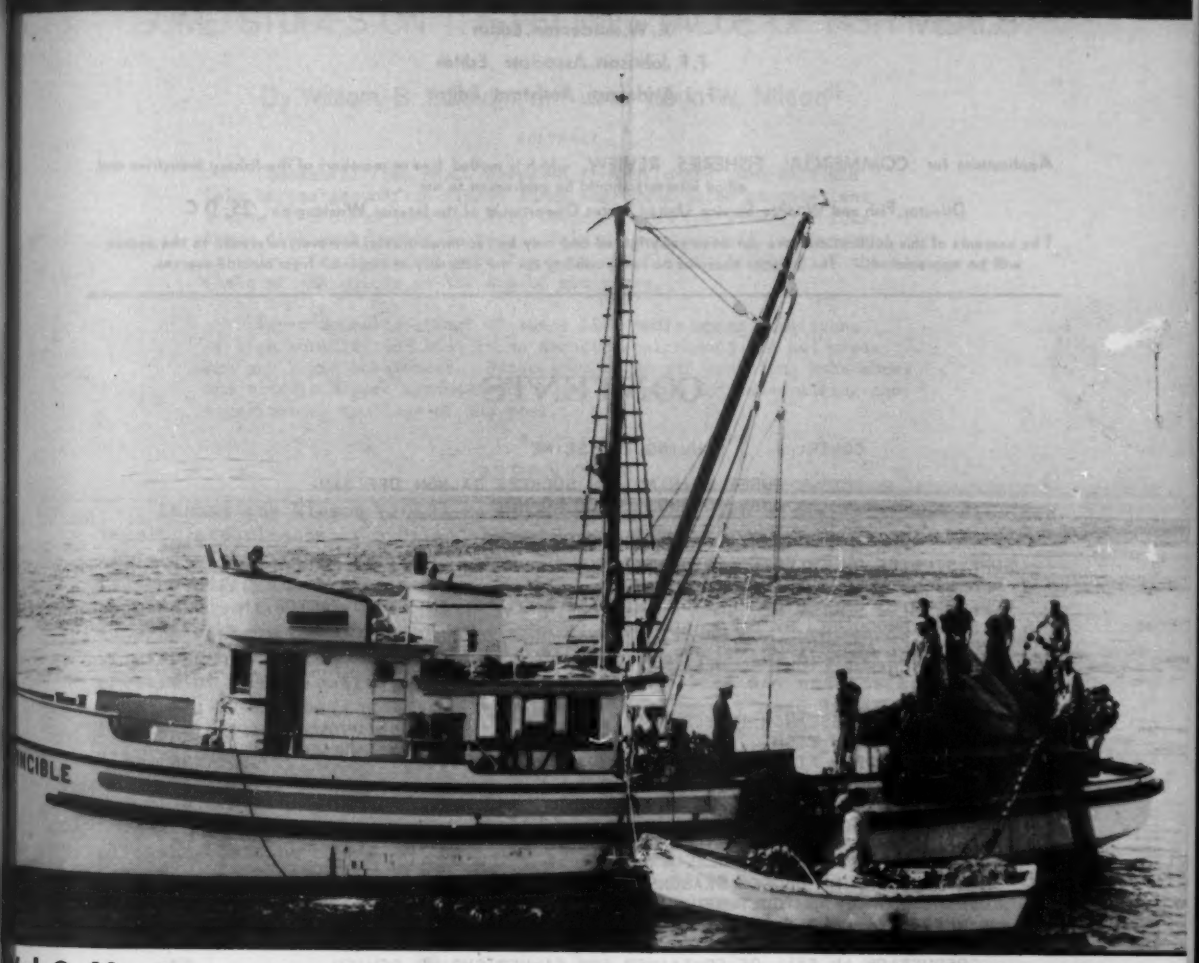
COMMERCIAL FISHERIES REVIEW



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COMMERCIAL FISHERIES REVIEW

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COMMERCIAL FISHERIES REVIEW

August 1947 Washington 25, D.C. Vol. 9, No.

SOME STUDIES ON THE FEEDING VALUE OF FISH MEALS

By William B. Lanham, Jr.* and Hugo W. Nilson*

ABSTRACT

Commercial fish meal prepared from pilchard, menhaden and lean marine groundfish fillet scrap was found to be an excellent source of protein in a properly balanced diet for growing chicks. These fish meals could be fed in fairly large amounts in diets and in only a few instances were fishy or off flavors detected in the flesh of the chicks at the end of six weeks.

Experimental spoilage of these fish meals under conditions of high humidity and heat in an aerobic environment did not produce any toxic substances. Water-soluble growth promoting substances and vitamin K were synthesized by the bacteria and molds during the experimental spoilage of the meal.

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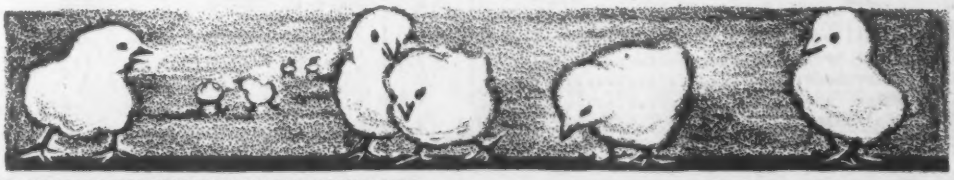
INTRODUCTION

Lanham and Nilson (1942) reported that chicks fed a semi-purified diet containing experimentally spoiled pilchard meal grew to a larger size, and with lower mortality than those fed a similar diet containing commercial meal. The diets fed contained about the maximum quantity of meal that could be incorporated into an otherwise complete diet; namely, 30 to 35 percent, in order to aggravate any adverse effects of spoilage. The data show that spoilage under aerobic conditions of excess heat and moisture did not adversely affect the nutritive value of the protein of the pilchard meal. It was concluded that any unsatisfactory results obtained in the feeding of diets containing commonly used levels of commercial fish meal are probably due to improper balance of the nutritive elements in the diet rather than to any toxic effect of the fish meal.

The hereinafter reported data are from two types of experiments. First, those from preliminary feeding tests with rats and chicks using meals prepared from pilchard (Sardina caerulea), menhaden (Brevoortia tyrannus), lean marine groundfish fillet scrap (commercial "whitefish" meal), and horseshoe crab (Limulus) in order to determine if any toxic factors may have been produced during experimental spoilage. Secondly, data are included from a rather extensive study with chicks to



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identify the factors which may have been responsible for the better growth of chicks fed the experimentally spoiled meals. The latter study was limited to pilchard meal.

The objects of the investigation were, first, to determine the identity of toxicosis or deficiency state produced in chicks when "commercial" meals were fed in conjunction with otherwise semi-purified foods, and secondly, to determine the identity of the growth factors, probably vitamins, produced during experimental spoilage of meals. During the latter stages of experimental work, the possibility was also explored of using the experimentally spoiled meal as a raw material for extraction of certain vitamins commercially. This phase of the study, however, was dropped when it became apparent that a scarcity of fish meal for feeding purposes would soon develop.

The experiments were conducted between January 1938 and September 1941. The preparation of these data for publication was delayed by the assignment of the authors to other duties during the war. Some of the basic data included in the publication by Lanham and Nilson (1942) are also included in this compilation.

EXPERIMENTAL METHODS AND DATA

Rat Feeding Experiment

The rats were allotted at an initial live weight of 48 to 55 g. into six groups of about nine rats each. They were housed individually in cages with screen floors; and, twice weekly records were kept of body weight and food consumption.

The following diet was fed during the 60-day experimental period: fish meal to equal 20 parts protein by weight; sucrose, 20; lard, 12; cod liver oil, 2; salt mixture, U.S.P. XI No. 2, 4; dried brewer's yeast, 2; wheat germ, 1; and dextrin to make 100 parts by weight. This diet was supplemented with 0.12 mg. of thiamine hydrochloride, and 1.2 mg. of crystalline riboflavin per kg. of diet.

Table 1 - Data on Crude Protein (N x 6.25) Content of Meals

Fish Meal	Percent by Weight	Fish Meal	Percent by Weight
Commercial pilchard meal	70.1	Commercial "whitefish" meal[1]	67.6
Spoiled pilchard meal	69.6	Spoiled "whitefish" meal[1]	65.1
Commercial menhaden meal	60.4	Horseshoe crab meal	61.5
Spoiled menhaden meal	65.5	Spoiled horseshoe crab meal	67.7

1/Made from lean marine groundfish fillet scrap.

Pilchard, "whitefish," and menhaden meals were tested by separate inclusion in the diet. Half of each sample was spoiled under conditions of high heat and

Table 2 - Data on Mean Food Intake and Mean Gain in Live Weight of Rats Fed for a 60-day Period with Diets Containing about 30 Percent Fish Meal

Diet Designation	Number of Rats	Mean Food Intake	Mean Gain in Live weight	Estimated Mean Gain in Live Weight[1]
Meal		Grams	Grams	Grams
Commercial pilchard	9	581.8	165.0	172.8
Spoiled pilchard	9	607.4	155.4	152.6
Commercial menhaden	9	521.9	136.3	169.0
Spoiled menhaden	10	633.9	167.3	153.5
Commercial "whitefish"	9	638.1	172.0	156.4
Spoiled "whitefish"	9	616.8	167.8	161.1

1/Estimated mean gain in live weight for equal food intake (Y-bx where b = 0.4157). Snedecor (1940).

humidity, by being first mixed with water to a thick paste, and then held at about 120° F. for one week in large shallow trays. The spoiled meals had extremely foul odors. The decomposition was purposely permitted to become more extensive than would occur under any but the most adverse storage conditions, in order to accentuate any alteration in the meal. The meals were then dried at a temperature under 120° F., finely ground, and stored in covered metal cans. (See Table 1, p. 2.)

Table 3 - Analysis of Covariance, and Test of Significance of Adjusted Mean Gain in Live Weight of Groups Reported in Table 2

Source of Variation	Degree of Freedom	SUM OF SQUARES AND PRODUCTS			ERRORS OF ESTIMATE		
		Sx^2	Sxy	Sy^2	Sums of Squares	Degrees of Freedom	Mean Square
Total	54	284,707.20	106,079.80	60,927.93	21,403.40	53	
Groups	5	85,477.18	23,252.39	7,794.05	2,703.99	5	540.80
Within groups	49	199,230.02	82,827.41	53,133.88	18,699.41	48	389.57
				F = 1.39 which is non-significant			

X = food intake Y = gain in live weight

All animals were in excellent health at the close of the 60-day experimental period. The data in Tables 2 and 3 show that there were no statistically significant differences in the estimated mean gain in live weight between groups fed the various fish meals. At the levels fed, one meal was as satisfactory as another.

Chick Feeding Experiment

Allotment and Equipment

Cross bred New Hampshire-Barred Plymouth Rock or Barred Plymouth Rock chicks were used in the chick feeding experiments. They were obtained from a local hatchery when one day old, and were allotted into groups having approximately equal mean weights, and with similar ranges in the weights of individual chicks. No record was kept of the initial or final distribution of sex. All chicks were individually banded.

Water was kept before them at all times. On the second day, the experimental diets were available for 15-minute periods each during the forenoon and afternoon. From the third day to the end of the experimental period, usually six weeks in duration, the chicks had access to food at all times. The chicks were housed in a battery cage in groups. The cages were located in a room in which the temperature was maintained close to 80° F. Each cage was also fitted with brooder facilities.

Diets Used

The diet consisted of a variable quantity of fish meal or protein supplement; sucrose, 15; lard, 5; salt mixture, U.S.P. XI No. 2, 2; agar, 2; dried brewer's yeast, 2; wheat germ, 1; cod liver oil, 2; and dextrin to make 100 parts by weight. Separate vitamin supplementation was also made.

The quantity of fish meal, or protein supplement fed varied for each series of experiments as follows:

Series 1 - 35 percent fish meal Series 3 - 18 percent protein equivalent
" 2 - 30 " " " " 4 to 10 - 22 " " "

For series 5 to 10, inclusive, all diets contained an additional 100 parts per million of manganese as $MnSO_4.4H_2O$. Manganese was added as a prophylactic against perosis. For series 6 to 10, inclusive, three percent soy-bean oil was

included in the diets at the expense of two percent lard and one percent dextrin. The soy-bean oil was added to supply vitamin K and the antiencephalomalacia and anti-gizzard erosion factors.

Chicks in series 1 to 6, inclusive, received 0.12 mg. thiamine hydrochloride, and 1.2 mg. crystalline riboflavin per kg. of diet. Those in series 7 to 10 received 0.36 mg. thiamine, and 1.2 mg. riboflavin per kg. diet. There were some exceptions which are noted in appropriate tables of data. The other dietary additions were made at the expense of an equivalent weight of dextrin.

In series 7 to 10, inclusive, a second control group was used in which the chicks were fed a commercial growing mash type of diet. The diet consisted of pilchard meal (about 65 percent protein), 7.5; meat scrap (about 50 percent protein), 7.5; dried skim milk, 5.0; ground yellow corn, 30.0; ground barley, 11.5; ground wheat, 10.0; wheat bran, 16.0; alfalfa meal, 7.5; ground limestone or oyster shell, 2.0; steamed bone meal, 1.0; salt, 1.0; and fish oil (containing 100 international units of vitamin D per gram), 1.0 to equal 100 parts by weight (Almquist, Jukes, and Newlon, 1938). The ration analyzed about 19.0 percent crude protein.

Data for Lactalbumin

Lactalbumin was selected as a reference protein after the first preliminary feeding studies had been completed. It is rated as being very high in nutritive quality, and is probably only partially deficient in argenine content. The chicks fed the diet containing lactalbumin should have grown to the maximum limit permitted by an adequate protein source.

The chicks fed this basal diet and certain modified diets did not grow well, and there was high mortality (Table 4). Even replacement of ten percent of the

Table 4 - Data on Gain in Live Weight and Food Consumption of Survivors, and on Mortality of Chicks Fed Lactalbumin as Principal Source of Protein

Diet Designation	Series	Group	Number of Chicks		Mean Life	Mean Food Intake	Mean Gain in Live Weight	Food per Gram Gain
			Initial	Final	Days	Grams	Grams	Grams
Lactalbumin:								
No addition[1]	3	4	10	4	30.5	189.3	20.8	9.10
Plus manganese[2]	5	6	8	6	36.3	393.9	113.5	3.47
Manganese and one percent argenine[2]	5	11	8	4	35.3	376.1	120.0	3.13
Plus soy-bean oil	6	9	7	0	12.9			
Replacement of 10 percent lactalbumin with equivalent weight of spoiled pilchard meal[3]	6	10	7	4	31.3	352.0	111.8	3.15

1/35-day test, all others were 42-day tests.
2/0.36 mg. thiamine and 3.6 mg. riboflavin per kg. diet.
3/One chick killed accidentally.

lactalbumin with an equivalent weight of spoiled pilchard meal did not promote better growth. No further studies were carried out with this source of protein since it was obvious that considerable experimental work would be needed to determine the inherent deficiencies.

Data for Menhaden and "Whitefish" Meals

There was no difference in the growth rate or health of rats fed the different commercial or spoiled meals. This was not true for chicks (Table 5). Series 1

chicks, for some unexplainable reason, grew very much better when fed the "no addition" diets containing the commercial meals than did those in subsequent series. The chicks suffered, however, from severe perosis. Also the mortality was very high with series 4 chicks.

Table 5 - Data on Gain in Live Weight and Food Consumption of Survivors, and on Mortality of Chicks Fed Menhaden, and "Whitefish" Meals as Principal Source of Protein For a 6-Week Period

Diet Designation	Series	Group	Number of Chicks		Mean Life	Mean Food Intake	Mean Gain in Live Weight	Food per Gram Gain
			Initial	Final	Days	Grams	Grams	Grams
Commercial Menhaden Meal:								
No addition	1	3	9	8	41.8	921.2	300.6	3.06
" "	4	5	8	1	30.4	277.5	73.0	3.80
		Summary	17	9	36.4	849.8	275.3	3.09
Plus manganese	4	11	8	0	18.9			
Spoiled Menhaden:								
No addition	1	4	9	9	42.0	706.6	298.4	2.37
" "	2	3	9	7	38.1	1045.6	371.6	2.81
" "	4	6	8	4	33.5	607.9	274.0	2.22
		Summary	26	20	38.0	805.5	319.2	2.52
Plus manganese	2	4	9	8	39.7	1024.6	325.3	3.15
" "	4	12	8	5	34.8	832.3	369.0	2.26
		Summary	17	13	37.4	950.7	342.1	2.78
Commercial "Whitefish" Meal:								
No addition	1	5	8	5	34.6	523.8	174.0	3.01
" "	4	3	8	0	21.1			
		Summary	16	5	27.9	523.8	174.0	3.01
Plus manganese	4	9	8	1	28.1	399.7	124.0	3.22
Spoiled "Whitefish" Meal:								
No addition	1	6	8	7	37.6	644.6	279.4	2.31
" "	4	4	8	3	33.9	541.3	291.3	1.86
		Summary	16	10	35.8	613.6	283.0	2.17
Plus manganese	4	10	8	8	42.0	674.8	304.1	2.22

In general, the chicks fed the spoiled menhaden or "whitefish" meals grew to a larger size, and required less food per unit gain in live weight than did those fed the commercial meals. The data indicate that one or more factors produced during spoilage at least partially alleviated the deficiency symptoms. There was no evidence of toxicosis when spoiled meals were fed.

Vitamin K Deficiency Study

It was noted that chicks fed the diet containing commercial fish meal had subcutaneous hemorrhages. About this time, some of the early work was published on reduction of blood clotting time with extracts prepared from fish meal or alfalfa meal. Blood clotting time determined with the glass capillary method varied from 2 to 24 minutes, with an average of 10 minutes, for 11 Leghorn chicks fed for one month after hatching with the standard diet containing 18 percent protein from commercial menhaden meal.

A petroleum ether extract was prepared from spoiled menhaden meal according to the method reported by Osterberg (1938). Another group of chicks were fed the beforementioned diet supplemented with 30 mg. of extract per 100 g. of diet. Thirteen chicks fed this diet had a blood clotting time of three minutes or less, and mostly less than two minutes.

At first, it was believed that the vitamin K deficiency, as indicated by the prolonged blood clotting time, was responsible for poor growth. This premise was

not necessarily correct because three chicks fed commercial pilchard meal had blood clotting times of 13, over 30, and over 46 minutes, and gained in live weight, respectively, 247, 244, and 124 g. (Table 7, series 5, group 13). Four chicks fed commercial pilchard meal plus three percent soy-bean oil had blood clotting times of 1, 2, 3, and 3 minutes, and gained in live weight, respectively, 163, 178, 127, and 249 g. (Table 7, series 5, group 2). Also three chicks fed spoiled horseshoe crab meal had blood clotting times of 1, 1, and 2 minutes, and gained in live weight, respectively, 139, 80, and 76 g. (Table 6, series 5, group 7).

Table 6 - Data on Gain in Live Weight and Food Consumption of Survivors and on Mortality of Chicks Fed Horseshoe Crab Meal as Principal Source of Protein[1]

Diet Designation	Series	Group	Number of Chicks Initial	Number of Chicks Final	Mean Life	Mean Food Intake	Mean Gain in Live Weight	Food per Gram Gain
					Days	Grams	Grams	Grams
42 DAY TEST								
Horseshoe Crab Meal:								
No addition	2	1	9	9	42.0	420.8	90.7	4.64
Plus manganese	5	5	8	7	37.5	723.8	212.4	3.41
" "	5	8	8	6	35.1	507.3	171.5	2.96
	Summary		16	13	36.3	623.9	193.5	3.22
Plus soy-bean oil[2]	5	9	8	6	33.9	572.8	165.2	3.47
Plus one percent argenine[2]	5	10	7	3	24.7	620.1	197.7	3.14
Spoiled Horseshoe Crab Meal:								
No addition	2	2	9	6	37.2	378.0	45.7	8.27
Plus manganese	5	7	8	7	39.3	444.9	99.6	4.47
Plus soy-bean oil, one percent argenine, and two percent tricalcium phosphate[2]	5	12	7	5	35.4	697.3	237.2	2.94
35 DAY TEST								
Horseshoe Crab Meal:								
No addition	3	1	10	8	34.0	201.9	31.4	6.43
Half protein replaced with lactalbumin	3	2	10	6	31.8	170.2	25.8	6.60
Plus alfalfa meal	3	3	10	8	34.4	209.5	33.4	6.27
31 DAY TEST								
Spoiled Horseshoe Crab Meal:								
No addition	3	5	10	3	24.3	179.6	17.3	10.38
Half protein replaced with lactalbumin	3	6	10	6	28.4	180.4	23.4	7.71
Plus alfalfa meal[3]	3	7	10	3	28.0	132.0	16.0	8.25

1/ Also called King crabs (Limulus). The crude protein content of horseshoe crab meal was 61.5 percent, and for spoiled meal was 67.7 percent (N x 6.25).

2/ 0.35 mg. thiamine, and 3.5 mg. riboflavin, instead of 0.12 mg. thiamine and 1.2 mg. riboflavin per kg. diet.

3/ Eight percent alfalfa meal, and enough horseshoe crab meal to make 18 percent protein.

Since the object of the experiment was to identify deficiency factors, rather than the extent of the deficiency, all chicks in series 6 to 10 were fed soy-bean oil at a level sufficient to furnish ample quantities of vitamin K, and the anti-encephalomalacia factor and the anti-gizzard erosion factor.

Data for Horseshoe Crab Meal

Two samples of horseshoe crab meal were obtained which had been produced under pilot plant conditions. There seemed to be no difference between the meals. Chicks in series 2 and 3, and series 5, group 8, were fed sample 1, and the remainder, sample 2 (Table 6). The series 3 chicks, which were fed horseshoe crab meal, except for group 4, which was fed lactalbumin (Table 4), grew so poorly that they had to be destroyed in 31 or 35 days.

Table 7 - Data on Gain in Live Weight and Food Consumption of Survivors and on Mortality of Chicks Fed Commercial and Spoiled Pilchard Meal, as a Principal Source of Protein, and a Commercial Type of Growing Mash for a 6-Week Period

Diet Designation	Series	Group	Number of Chicks Initial	Number of Chicks Final	Mean Life	Mean Food Intake	Mean Gain in Live Weight	Food per Gram Gain
					Days	Grams	Grams	Grams
Growing Mash	6	2	10	7	31.4	950.1	340.4	2.79
" "	7	9	10	8	34.6	1151.9	361.9	3.18
" "	8	12	10	9	38.7	1023.1	373.0	2.74
" "	9	4	10	10	42.0	1094.8	451.8	2.42
" "	10	4	11	11	42.0	1156.1	484.0	2.39
	Summary		51	45	37.8	1083.1	410.6	2.64
Commercial Pilchard Meal:								
No addition	1	1	9	2	24.8	565.8	205.5	2.75
" "	4	1	8	2	25.5	477.6	137.0	3.49
	Summary		17	4	25.1	521.8	171.3	3.05
Plus manganese	4	7	8	0	26.8			
" "	5	1	8	0	19.4			
" " 1/	5	13	8	4	30.8	568.1	197.5	2.88
	Summary		24	4	25.6	568.1	197.5	2.88
Plus soy-bean oil	5	2	7	4	34.9	470.2	179.3	2.62
" " " "	6	1	10	0	22.2			
	Summary		17	4	27.4	470.2	179.3	2.62
Higher level thiamine	7	8	10	8	38.8	707.0	305.6	2.31
" " "	8	1	10	9	40.3	622.6	258.0	2.41
" " "	9	3	11	10	40.8	676.6	292.2	2.32
" " "	10	1	11	3	27.3	386.9	137.0	2.82
" " "	10	10	10	6	32.4	538.0	121.2	4.44
	Summary		52	36	35.8	622.6	245.2	2.54
Spoiled Pilchard Meal:								
No addition	1	2	9	8	41.9	764.6	329.6	2.31
" "	4	2	8	2	34.8	476.3	112.5	4.23
	Summary		17	10	38.5	707.0	286.2	2.47
Plus manganese	4	8	8	6	37.0	664.6	260.7	2.55
Commercial Pilchard Meal:								
Five percent of meal used was spoiled 2/	5	3	8	4	30.1	844.0	374.8	2.25
Twenty-five percent of meal used was spoiled 2/	5	4	8	7	39.9	921.6	389.1	2.37
Ten percent of meal used was spoiled	7	10	10	10	42.0	1034.3	506.9	2.04
" " " " " " "	8	6	10	8	36.6	883.1	422.1	2.09
" " " " " " "	9	5	10	9	38.7	887.6	478.1	1.86
" " " " " " "	10	5	10	10	42.0	923.1	465.4	1.98
	Summary		40	37	39.8	932.0	468.1	1.99
Plus soy-bean oil, and water extract equivalent to 10 percent spoiled meal	6	4	10	6	32.6	610.3	280.5	2.18
Water extract equivalent to 10 percent spoiled menhaden meal	7	14	10	7	35.3	709.8	401.0	1.77
Water extract equivalent to 10 percent spoiled pilchard meal (higher level thiamine)	9	6	10	10	42.0	970.7	567.7	1.71
Water extract equivalent to 10 percent spoiled pilchard meal (higher level thiamine)	10	6	10	10	42.0	920.1	476.2	1.93
	Summary		20	20	42.0	945.4	522.0	1.81
Same as above plus 10 mg. pantothenic acid per 100 g. diet	10	8	11	10	38.6	1026.2	523.2	1.96

1/ A second sample of pilchard meal.

2/ 0.36 mg. thiamine and 3.6 mg. riboflavin per kg. diet. This level of thiamine and riboflavin was also fed to all groups of series 7 to 10.

None of the chicks fed horseshoe crab meal grew satisfactorily, and the results were so uniformly poor that no further experimental work was conducted with this meal.

Data for Commercial and Spoiled Pilchard Meals

The chicks fed the commercial pilchard meal, unsupplemented or with added manganese or soy-bean oil did not grow well, and there was a high rate of mortality (Table 7). The threefold increases in the level of thiamine fed to these groups helped considerably in reducing mortality in most instances but did not materially affect growth rate.

Feeding spoiled pilchard meal helped some, and particularly when ten percent spoiled meal was substituted for an equivalent weight of commercial meal in the series in which the chicks received diets supplemented with manganese, soy-bean oil, and the higher level of thiamine. Chicks which received all of the supplements grew as well and with as economical use of food as those fed the growing mash.

For the first time, therefore, satisfactory growth was obtained with the experimental basal diet using mostly commercial meal as a source of protein. The spoiled meal was the source of one or more factors that permitted satisfactory growth. The meals were then extracted with various solvents to determine whether the factors were vitamin or protein in nature.

For all experiments, the spoiled meal was prepared by the method explained in the section on the rat feeding experiment. A crude water extract was prepared when this meal was stirred with warm water, about 120° F., allowed to settle, and the liquor was decanted. The extraction was repeated three or four times, the total quantity of water equalling to 8 to 10 times the weight of meal. This extract was centrifuged and the clear liquor was decanted off and concentrated under vacuum at a temperature not exceeding 130° F. to 10 percent total solids. This concentrate was mixed with dextrin, and dried at room temperature. The extract contained only about 0.7 percent of the original nitrogen of the meal.

Extract equivalent to the 10 percent, by weight, of spoiled meal was incorporated into the diet containing commercial pilchard meal. The chicks fed the water extract grew very well, and the mortality was low. These results indicated that quality of protein was not a limiting factor. The good results seemed to be due to some water soluble fraction, probably one or more of the water soluble vitamins.

Fractionation Studies of Water Extract

The water extract of spoiled meal was subjected to a series of fractionations in order to determine whether the growth-promoting factors could be separated or concentrated. The data in Tables 8 and 9 indicate that the untreated water extract and that autoclaved for one hour at pH 8.5 and 15 lbs. pressure, permitted a mean gain in live weight for the group that was significantly better than the over-all mean. One of the two control groups fed 10 percent spoiled meal (series 7, group 10) also made superior gains. These data indicate that the factor is not heat labile during a rather short period under mild conditions.

On the other hand, the addition to the diet of products extractable with fat solvents, diethyl ether and ethyl alcohol, permitted only very poor growth with an even higher rate of mortality than when the unsupplemented diet containing only commercial pilchard meal was fed. The sought-for factor or factors definitely could not be extracted with these solvents.

Fuller's earth apparently was a poor adsorbent for the active material. The chicks fed either the fuller's earth before elution or two different elution products did not grow well. The mortality was also very high when the uneluted fuller's earth was fed. These data indicate that the chicks were unable to utilize what little material was adsorbed on the fuller's earth.

Table 8 - Data on Gain in Live Weight and Food Consumption of Survivors and on Mortality of Chicks Fed for a 6-Week Period on Various Extracts Made From Spoiled Pilchard Meal, and Added to a Diet in which Commercial Pilchard Meal was the Principal Source of Protein

Diet Designation	Series	Group	Number of Chicks Initial	Number of Chicks Final	Mean Life	Mean Food Intake	Mean Gain in Live Weight	Food per Gram Gain
					Days	Grams	Grams	Grams
Water extract, total	7	1	10	9	41.7	847.5	490.6 1/	1.73
Ether extract	7	2	10	6	32.2	673.1	302.0 1/	2.23
Water extract, pH 8.5 and autoclaved at 15 lbs. for one hr.	7	3	10	6	33.9	1021.2	499.2 1/	2.05
Fullers' earth filtrate, pH 5	7	4	10	8	35.5	874.4	450.1	1.94
Fullers' earth eluted with barium hydroxide 2/	7	5	10	9	38.9	743.9	315.9	2.35
Fullers' earth eluted with pyridine-methanol 3/	7	6	10	8	40.5	737.7	345.0	2.14
Fullers' earth before elution	7	7	10	5	32.8	680.2	279.6 1/	2.43
Water extract, concentrated under vacuum under 50° C.	8	5	10	10	42.0	800.0	412.8	1.94
Water extract, pH 11 with NaOH and refluxed 3 hrs.	8	3	10	2	17.8 1/	847.5	321.5	2.64
Water extract, pH 1 with HCl, fullers' earth liquid pH 7 and concentrated	8	4	10	7	34.5	951.1	430.4	2.21
Water extract, ethyl alcohol solids	8	13	10	6	30.6 1/	525.8	218.8 1/	2.40
Water extract, ethyl alcohol washings	8	2	10	8	36.7	812.1	402.5	2.02

1/ A statistically significant difference at 5 percent level from means used in data in Table 9. Over-all mean gain in live weight is 381.13 g. and over-all mean length of life is 35.93 days.

2/ Two-tenths normal barium hydroxide was used. The barium was precipitated with sulfuric acid, and filtrate was fed.

3/ A mixture of 1:1:4 pyridine, methanol, and water. The pyridine was removed and the filtrate was fed.

Table 9 - Analysis of Variance for Data on Gain in Live Weight and Length of Life for Groups Reported in Table 8 and also Control Groups 1/ in series 7 and 8

Source of variation	Degrees of Freedom	Sums of Squares	Mean Square
Gain in live weight:			
Total	118	1,724,477.1	
Groups	15	916,836.9	61,122.46
Within groups	103	807,640.2	7,841.17
	F = 7.80 which is highly significant		
Days length of life:			
Total	159	21,472.1	
Groups	15	5,518.7	367.91
Within groups	144	15,953.4	110.79
	F = 3.32 which is highly significant		

1/ Series 7, group 8, and series 8, group 1, fed commercial pilchard meal.
Series 7, group 10, and series 8, group 6, fed 10 percent spoiled meal (Table 7).

The active material was also definitely destroyed when refluxed with alkali. This is a rather drastic treatment, and would destroy most known water soluble vitamins. The chicks fed the alkali refluxed extract grew less well than the poorest of the two groups fed commercial meal alone (series 8, group 1).

Table 10 - Data on Gain in Live Weight and Food Consumption of Survivors and on Mortality of Chicks Fed for a 6-Week Period on a Diet Containing Commercial Pilchard Meal as Principal Source of Protein to Which Were Added Various Supplements

Diet Designation	Series	Group	Number of Chicks Initial	Number of Chicks Final	Mean Life Days	Mean Food Intake Grams	Mean Gain in Live Weight Grams	Food per Gram Gain Grams
Plus soy-bean oil:								
Three percent dried brewer's yeast 1/	6	5	10	2	20.7	399.5	151.5	2.64
Five percent alfalfa meal	6	11	10	1	20.5	591.4	257.0	2.30
One percent wheat germ oil	6	7	10	3	22.6	516.2	234.3	2.20
One percent liver extract 2/	6	6	10	0	12.4			
Nicotinic acid, 5 mg. per 100 g.	6	8	10	1	10.0	455.3	171.0	2.66
Plus added thiamine:								
Ten percent autoclaved peanuts 3/	7	13	10	9	41.0	786.2	403.8	2.17
Five percent dried kelp meal	7	15	10	9	41.4	832.2	428.9	1.94
One percent rice bran concentrate 4/	7	11	10	10	42.0	1002.9	448.4	2.24
One percent rice bran concentrate	8	11	10	9	41.1	773.5	398.6	1.94
	Summary		20	19	41.6	888.2	403.6	2.20
Three percent rice bran concentrate	8	9	10	8	36.1	885.8	453.1	1.95
" " " "	9	8	10	10	42.0	1005.0	531.7	1.89
	Summary		20	18	39.1	945.4	492.4	1.92
One percent liver extract	7	12	10	5	31.0	998.7	460.6	2.17
Two " " "	8	7	10	10	42.0	927.6	467.1	2.20
" " " "	9	2	10	10	42.0	1009.7	560.2	1.80
" " " "	10	7	10	8	37.6	988.4	547.5	1.81
	Summary		30	28	40.5	975.2	524.9	1.86
Pyridoxine, 0.3 mg. per 100 g.	8	8	10	6	31.6	661.6	263.7	2.51
Pyridoxine, 0.6 mg. per 100 g.	8	10	10	6	33.5	816.5	240.2	3.40
Five percent chondroitin	9	7	10	8	36.8	631.5	221.5	2.85
p-aminobenzoic acid, 0.05 g. per 100 g.	10	9	11	6	34.0	544.7	206.5	2.64
Pantothenic acid, 10 mg. per 100 g.	9	1	11	11	42.0	883.8	528.4	1.67
Pantothenic acid, 10 mg. per 100 g.	10	2	10	8	37.8	741.2	378.9	1.96
	Summary		21	19	39.9	812.5	453.7	1.79
Pantothenic acid, 20 mg. per 100 g.	10	3	10	8	39.7	808.7	415.0	1.95

1/Anheuser-Busch Inc., strain K yeast.
2/Eli Lilly and Company liver extract Lilly.
3/Raw peanuts were autoclaved for five hours at 15 pounds pressure.
4/National Oil Products Co., Harrison, N. J. Vitab type II concentrated aqueous extract of rice bran.

It was not possible to make a covariance analysis of gain in live weight and food consumption since the chicks were fed by groups instead of as individuals. In general, the groups which grew the best required the least food per unit gain in live weight. Considerable reliance, in this instance, can be placed on the

estimate of significance of differences by analysis of variance for gain in live weight, since the group means which were significantly better or poorer than the over-all mean can be correlated with the fractionation study.

The active material was resistant to a reasonable degree of heat, and to a fairly strong acid. The active material was probably neither an amino acid or a protein, since so little nitrogen was found in the water extract. A mineral element was probably not involved because the active material was destroyed when refluxed with alkali. The growth-promoting activity was apparently due to one or more water-soluble organic compounds.

Data on Supplementation Studies

The fractionation studies reported in the preceding section indicated that the active material consisted of one or more organic compounds. Rather than to isolate and identify these, a series of feeding studies were conducted in which the basal commercial pilchard meal diet was supplemented with concentrates or pure vitamins.

The data in Table 10 indicate that the higher level of thiamine was essential to satisfactory growth. This interpretation may have to be modified somewhat since series 6 chicks did not grow as well as those from several other series. The three percent brewer's yeast should have been a good source of thiamine.

Pyridoxine, chondroitin, p-aminobenzoic acid were not helpful. The added nicotinic acid also probably was not needed. Autoclaved peanuts and dried kelp meal both contained the active material to a reasonable degree. It is, however, not possible without repetition of experiments to come to any conclusion on the value of either the yeast or alfalfa meal.

Table 11 - Analysis of Variance for Data on Gain in Live Weight of Selected Groups of Chicks Receiving Diet Containing Commercial Pilchard Meal Plus Supplements

Source of variation	Degrees of Freedom	Sums of Squares	Mean Square
Total	121	1,226,460.8	19,011.43
Groups	4	76,045.7	9,832.61
Within groups	117	1,150,415.1	
	F = 1.93 which is not significant		

Note: Over-all mean gain in live weight = 494.10 g.
Thirty-seven surviving chicks fed 10 percent spoiled meal, 20 fed equivalent water extract, 18 fed 3 percent rice bran concentrate, 28 fed 2 percent liver extract, and 19 fed 10 mg. pantothenic acid of per 100 g. of diet (Tables 7 and 10).

Pantothenic acid, liver extract, and rice-bran concentrate were the best supplements. The data in Table 11 show that growth obtained with these supplements was not significantly different from that obtained with spoiled pilchard meal or with the water extract of spoiled meal.

DISCUSSION

The basal diet that was used is not commercially practical, but it did permit feeding large quantities of fish meal. Except for horseshoe crab meal, the meals used apparently supplied sufficient high quality protein to promote satisfactory growth. Furthermore, experimental spoilage of meal under conditions of high temperature and humidity, and under an aerobic environment, did not produce any toxic products.

On the other hand, growth-promoting factors in addition to such accessory factors as vitamin K were synthesized by bacteria and molds during the experimental

spoilage. These factors were extractable with water and could withstand enough heat so the water extract could be concentrated and dried on dextrin. No attempts were made to isolate and identify these compounds.

Further studies showed that rice-bran concentrate, liver extract, and pantothenic acid when added singly to the commercial pilchard meal diet, did permit equivalent growth to that produced when one-tenth of the commercial meal was replaced by spoiled meal, or when the diet was supplemented with an equivalent amount of the water soluble extract of the spoiled meal. Whether pantothenic acid is the only vitamin involved cannot be determined from these studies. From the practical standpoint, further work along these lines seems hardly worthwhile. Nor is an extensive review of literature indicated to correlate the results, since experimental diets and conditions vary widely, and the data are difficult to interpret in terms of the requirements for essential food elements, especially for vitamins.

At the close of the experimental period, all of the chicks of sufficient size were killed, skinned in most instances, and dressed. These were distributed to various staff members who had them cooked and taste-tested at their homes. No fishy or other off flavors were reported, except for a few chicks which were not allotted to any single group. For most groups, no chicks were reported as having fishy or other off flavors. Some randomly selected birds were plucked rather than skinned. The skin or subcutaneous fat did not have any off flavor unless it was present in the flesh.

CONCLUSIONS

1. The commercial fish meals which were fed are an excellent source of protein, and can be incorporated in rather large amounts, if necessary, into a properly balanced diet without deleterious effects.

2. Experimental spoilage under conditions of high heat and humidity, and in an aerobic environment, does not produce toxic products.

3. Water-soluble growth factors and vitamin K are synthesized by bacteria and molds during the experimental spoilage.

4. In only a few instances will fishy or other off flavors be detected in the flesh of chicks fed comparatively large quantities of commercial or spoiled fish meal during a six-week period.

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SOME STUDIES ON THE CONTENT OF THIAMINE AND ANTI-THIAMINE FACTOR IN FISHERY PRODUCTS

By Clara Gale Goldbeck*

ABSTRACT

Data are presented which indicate that most fishery products contain from 50 to 200 micrograms of thiamine per 100 grams of material. Very few species were found to contain the anti-thiamine factor. Experiments are reported on concentration of the anti-thiamine factor from viscera of carp.

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INTRODUCTION

In 1941, when our work was begun, comparatively little was known concerning the factors affecting the chemical assays for thiamine and the anti-thiamine factor in fishery products. It was necessary to investigate various chemical procedures in order to determine their relative importance in permitting true assays. The results presented in this article were made available to interested government agencies and individuals, but no summary has been prepared previously.

The determination of the chemical structure of thiamine and the synthesis of the crystalline compound made it possible to determine the daily requirements of this vitamin for persons of different age groups and physical and physiological activity. These requirements were then defined in terms of an actual weight of thiamine, rather than in the empirical international units of activity which had been adopted at the 1934 conference of the Committee for Biological Standardization, League of Nations.

Later, the Council on Foods and Nutrition, National Research Council, in this country proposed daily allowances of thiamine for various categories of age, sex, and activity. The allowances are, on the whole, rather generous, since an excess amount of thiamine is recommended which will safely permit optimum growth or physiological activity.

The anti-thiamine factor was first discovered as a deficiency disease in foxes which were fed certain raw fish in the diet. A survey of the literature will not be made here, because quite comprehensive reviews are now available to those who are interested in the subject. The anti-thiamine factor is of little consequence in human nutrition since practically no raw fishery products are consumed which contain this factor. For animals, too, it is of only secondary importance because cooking rather easily destroys the factor. Cooked fish can be included in the rations without experiencing any difficulties due to the anti-thiamine factor.

A number of biological and chemical methods have been promulgated for the assay of thiamine. One of the first methods proposed was a curative test with

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pigeons which had been fed a deficient diet until acute symptoms of polyneuritis developed. A similar curative test with rats was standardized and made mandatory for official assays according to the Pharmacopoeia of the United States (XII).

The gain in live weight of dogs or rats initially suffering from polyneuritis, when fed diets containing various levels of thiamine and foods, has been used to estimate potency. One method utilizes the duration of recovery of normal rate of heart beat in rats initially suffering from bradycardia because of thiamine deficiency. Another method is based on the increase in oxygen uptake of avitaminotic pigeon brain in pyruvic acid solution as the result of adding thiamine-containing substances. Biological assay methods with humans to determine requirements have usually involved estimating the urinary excretion of thiamine after feeding known amounts of foods or crystalline thiamine under controlled conditions.

Micro-biological assay methods using yeast and bacteria are being employed quite extensively, particularly the yeast fermentation method. This method is based on the fact that the rate of fermentation by yeast is proportional to the thiamine content of the media under controlled conditions. The quantity of carbon dioxide evolved is the usual measure of activity.

The two chemical methods most widely used are the colorimetric method promulgated by Prebluda and McCollum (1939), and the thiochrome method first developed by Jansen (1936). In the colorimetric method, the thiamine treated with a reagent consisting of diazotized p-aminoacetophenone produces a red dye. The dye is dissolved in xylene, and the concentration is determined by means of a colorimeter or photoelectric photometer. This method has not been found to be sensitive enough for use in assaying foods having a comparatively low concentration of thiamine. The thiochrome method is based on the oxidation of thiamine to thiochrome by alkaline potassium ferricyanide. The thiochrome is extracted with isobutyl alcohol, and the concentration is determined by the amount of fluorescence produced.

EXPERIMENTAL METHODS FOR THIAMINE ASSAYS

For the experimental work reported herein, the thiochrome method was used because it seemed to offer the best possibilities for assaying fishery products containing low concentrations of thiamine. A rat growth method was used as a biological check for some of the assays.

The method finally adopted, after considerable testing of modification in methods, was a variant of the method devised for general use by Hennessy and Cerecedo (1939). A 5 to 15 g. sample, depending on the dry matter content and probable thiamine content, was boiled for 30 minutes in a 250 ml. Erlenmeyer flask with dilute acid. Two percent acetic acid was usually used, although 0.1N sulfuric or hydrochloric acid can be used instead. Sodium acetate (2.5N) was used to adjust the pH to 4.0 to 4.5 after the solution was boiled. One-fourth gram of takadiastase, or other active phosphatase was added and the mixture was incubated overnight at 37° or for 3 hours at 50° C. After incubation, the solution was centrifuged and filtered into a 100 ml. volumetric flask. The residue was stirred with water, heated in a water bath, recentrifuged, and the supernatant liquid was added to the original solution. The solution was made up to volume, and aliquots were used directly in the oxidation procedure, or first given the base exchange treatment.

The necessity for using a phosphatase digestion was recognized when assaying samples of oysters. At first, only a pepsin digestion was used, but the values decreased until no thiamine was found in a sample of oysters from Maryland. A

takadiastase digestion was tried, and 100 micrograms of thiamine were found per 100 g. of raw oysters.

In the base exchange treatment, the modified Hennessy method (1941) was carried out as follows: 80 to 100 mesh Decalso was stirred 4 times with 10-volume portions of 3 percent acetic acid for 10 minutes each. Between the second and third washings, the Decalso was stirred with 5 volumes of 25 percent potassium chloride for 15 minutes. It was finally washed thoroughly with water. The base exchange tubes were about 20 cm. long and 5 mm. in diameter with a capillary tube at the bottom end and a funnel holding about 25 ml. on the top end. A plug of glass wool was placed at the junction of capillary and tube, and the activated Decalso suspended in water was poured into the tube until the settled material was 5 cm. deep.

After the water was drained from the tube, an aliquot of the sample containing up to 10 micrograms of thiamine was added. The liquid was permitted to drain out, and three 20-ml. portions of water were pulled through the Decalso with suction. The suction had to be broken before the water level reached the Decalso column to avoid drawing in air which may have caused channeling. Elution of the thiamine was accomplished by using a solution of 25 percent potassium chloride. The rate of flow should be about 1 ml. per minute. Twenty-five ml. of eluate were collected unless the quantity of adsorbed thiamine was very small. In this case, a smaller quantity was collected to avoid too great a dilution. The standards to be used in reading the unknown were treated in a similar manner. The Decalso columns were generally used only once.

This method of base exchange treatment to remove interfering substances was not usually used in assaying the fishery products. In most cases, the blank readings were small, and there was no evidence of the presence of interfering substances. The base exchange procedure could, however, also be used as a means for concentrating the vitamin, although there is some doubt that the Decalso is able to adsorb all of the vitamin. The error due to incomplete adsorption can be accounted for to a considerable extent by treating the standards with Decalso.

The treatment to prepare the samples for reading of fluorescence was as follows: 13 ml. of isobutyl alcohol were placed in a 30 ml. capacity separatory-centrifuge flask. Five ml. of the water extract, either with or without previous base exchange treatment, were added to the alcohol. Three ml. of oxidizing solution, prepared by dissolving $\frac{1}{2}$ g. of potassium ferricyanide in 50 ml. of 15 percent solution of sodium hydroxide, were added and the mixture was immediately shaken for $1\frac{1}{2}$ minutes, then centrifuged at a low speed for $\frac{3}{4}$ minute. The aqueous layer was drawn off, and $1\frac{1}{2}$ g. of anhydrous sodium sulfate were shaken with the alcohol. The solution was again centrifuged. Ten ml. of the isobutyl alcohol solution were transferred to a cuvette, and an estimation of the fluorescence was made with the aid of a Pfaltz and Bauer fluorometer. A blank was prepared according to the same procedure, except that three ml. of a 15 percent solution of sodium hydroxide were used instead of a like amount of the oxidizing mixture. The value obtained for the blank was subtracted from that of the unknown, and the difference represented the fluorescence due to the thiochrome. The thiochrome content was determined by comparing the fluorescence obtained for the test sample, with that obtained for a similar sample to which a known amount of thiamine had been added.

In conducting the rat growth method of assay, weanling rats with an initial live weight of 40 to 50 g. and not more than 30 days in age were fed a thiamine deficient diet until they ceased to gain in weight. The diet consisted of sucrose, 60; casein, 18; autoclaved peanuts, 10; autoclaved dried brewer's yeast, 5; salt mixture, U.S.P. XII, No. 2, 4; sodium bisulphite treated liver extract, 1;

and cod liver oil, 2 parts by weight. To this was added 100 micrograms of pyridoxine per 100 g. of diet.

When the rats ceased to gain in weight, they were placed in individual cages and allotted into comparable groups. One group was fed the basal deficiency diet. This was the negative control group. Three groups were fed the basal diet containing 15, 25, and 35 micrograms of added crystalline thiamine per 100 g. of diet. These diets were fed ad libitum. The individual increase in weight over a 4-week period was plotted against the thiamine intake in order to establish a standard curve.

Other groups of rats were fed the basal diet ad libitum plus varying daily allowances of the food to be assayed. The food to be assayed was ground thoroughly and quick frozen. The frozen product was weighed out daily, and fed to the individual rats from small glass cups. All rats consuming satisfactory quantities of food as compared with those fed the basal diet plus crystalline thiamine were included as assay animals. The individual increase in weight was plotted against the indicated thiamine intake as derived from the standard curve. The indicated intake of thiamine in micrograms divided by the grams of fish consumed, times 100 equals the thiamine content in micrograms for 100 g. of fishery product.

EXPERIMENTAL DATA FOR THIAMINE ASSAYS

The samples of fresh or frozen fishery products were obtained from local dealers, or were shipped in directly from a firm in the area of production. The samples of canned products were purchased from local retail stores.

Test samples were selected which represented as closely as possible the edible material, either raw or processed, of products available for home consumption. The flesh was finely ground through a food chopper, or, if possible, liquified in a Waring Blendor.

Thiamine in Oysters

The assays with raw shucked oysters (Ostrea virginica) were conducted for two reasons; first, to determine if regional variations occur, and secondly, to determine the effect of different commercial packing methods on the thiamine content. The following data indicate the average value, or range in values found with samples obtained from different areas:

State	Thiamine per 100 grams of raw oysters	State	Thiamine per 100 grams of raw oysters
	Micrograms		Micrograms
Louisiana	110 - 130	Maryland	100 - 103
Georgia	98 - 106	New York	170 - 180
Virginia	100 - 110	Connecticut	170

These data indicate that the oysters in the North contained more thiamine per unit of fresh weight than those from the South. It is well known that the oysters in the North grow at a slower rate, and this may be a factor in determining the concentration of vitamin. The oysters in the South also have a lower dry matter content.

Commercial packers also use different methods of handling the oysters before packaging. Some studies were conducted to determine the effect of different methods, such as shucking dry, shucking into water and holding in water, blowing in

water for varying periods of time, etc., on the thiamine content. The data obtained with oysters from Green Point, Long Island, N. Y. are presented in Table 1.

Table 1 - The Dry Matter and Thiamine Contents of Oysters Handled in Different Ways After Shucking

Sample	Treatment	Dry Matter Content	Thiamine per 100 Grams of Raw Oysters
		Percent	Micrograms
14A	Fresh shucked	18.5	190
14B	Shucked dry, and held dry	18.8	186
14C	Shucked into a perforated can, and held dry	23.3	209
14D	Blown for 3 minutes in fresh water	17.1	170
14E	Blown for 3 minutes in salt water	19.6	191
17F	Fresh shucked, dried on towel	24.0	246
15A	Fresh shucked	18.8	176
15C	Shucked dry, and held dry	21.7	236
15D	Blown for 3 minutes in fresh water	15.1	152
23A	Fresh shucked	19.5	177
23B	Held in water for 2 hours and blown for 10 minutes in fresh water	14.1	166
23C	Held dry for 1 hour and blown for 3 minutes in fresh water	19.0	210

These data indicate that there is a close correlation between the thiamine content and the dry matter content of these oysters. The samples were divided into three groups; namely, those freshly shucked or equivalent (14A, 14E, 15A, and 23A), those held dry or equivalent (14C, 17F, 15C, and 23C), and those held wet (14B, 14D, 15D, and 23B). The chi square test for the goodness of fit showed that the thiamine content was a function of the dry matter content, and there was no appreciable loss due to washing, blowing, or draining soon after the oysters were shucked.

Comparable assays were conducted by the thiochrome and the rat growth methods to determine the desirability of using the thiochrome method for assay of fishery products. Two groups of rats were fed the raw oysters at a rate of 1 and 1½ g. per day per rat. It was necessary to use several lots of oysters in the feeding tests. The average thiamine content obtained by the thiochrome method was about 175 micrograms, and that obtained by the rat growth method was about 160 micrograms per 100 g. of oysters. The difference in mean values is about 9 percent which is small enough to indicate reasonably good agreement.

Thiamine in Other Fishery Products

The data in Table 2 were obtained for the thiamine content of other fishery products. The results are expressed to the nearest 5 micrograms per 100 g. of product, and the range in values are given when more than a single sample was assayed.

It may be noted that most fishery products are a fair source of thiamine. Compared with a recommended allowance of 1.8 mg. of thiamine per day for a moderately active man, a serving portion of fish (equivalent to about 100 g.) would supply less than 1/10 of the daily allowance. These values are for raw seafood; cooked and canned products contain less thiamine. Fishery products are in the same category, however, as lean beef and poultry as a source of this vitamin. An interesting observation is that only a comparatively few species of fish contain the anti-thiamine factor in the flesh.

There were no indications of the presence of substances which interfered with the normal development of fluorescence due to thiamine with most fishery

products. The blank samples showed very little fluorescence, and the base exchange treatment did not effect the values. This was not true with samples of canned Atlantic Coast mackerel. The fluorescence of the blanks prepared from the mackerel extract was four to six times greater than that obtained ordinarily. The base exchange treatment did not reduce this value. There was also a considerable increase in fluorescence in the test samples. The difference between these two values was much greater than could be accounted for by the probable vitamin content. In fact, the canned product was seemingly a better source of thiamine than the raw

Table 2 - Data on the Thiamine Content of Some Fishery Products

Fishery Product	Thiamine per 100 g. of Edible Portion	Fishery Product	Thiamine per 100 g. of Edible Portion
	Micrograms		Micrograms
Fresh or frozen:		Fresh or frozen:	
Anglerfish (Lophius piscatorus)	25	Sea robin (Prionotus, species)	80 - 100
Burbot (Lota maculosa)	450 - 460	Shark, dogfish (Squalus acanthias)	50
Carp (Cyrinus carpio)	X*	Skate (Raja, species)	20 - 30
Cod (Gaddus callarias)	40 - 50	Smelt, lake (Osmerus mordax)	X*
Croaker (Micropogon undulatus)	155	Snapper:	
Haddock (Melanogrammus aeglefinus)	100	Gray (Lutianus griseus)	170
Grouper, black (Garrupa nigrita)	160 - 180	Red (" blackfordii)	170 - 180
Herring, lake (Leucichthys artedi)	100 - 115	Swellfish (Spheroides maculatus)	50
Mackerel:		Crab, blue (Callinectes sapidus)	75
Boston (Scomber scombrus)	170 - 200	Mussels (Mytilus edulis)	X*
King (Scomberomorus regalis)	50 - 60	Cooked:	
Spanish (" maculatus)	160 - 200	Salmon, red, baked	85 - 90
Mullet (Mugil, species)	55	Crab, blue, hard shell	60
Muttonfish (Lutianus analis)	40	Crab, blue, soft shell	85 - 100
Pompano (Trachinotus, species)	400 - 425	Canned:	
Salmon, red (Oncorhynchus nerka)	125 - 135	Crab, blue, white meat	None
		Salmon, pink	25

*X means that the anti-thiamine factor was present.

product. When $\frac{1}{2}$ g. a day of mackerel was fed to rats, the probable thiamine content was calculated to be 230 micrograms per 100 g. for the raw, and 26 micrograms for the canned product. The thiochrome method assayed about 200 micrograms per 100 g. for the raw flesh.

The solution to this problem was found in using a method suggested by Mason and Williams (1942). To a 5 to 25 ml. aliquot of the digested extract which had been adjusted to a pH of 5, were added 25 mg. of anhydrous sodium sulfite. The mixture was heated in a boiling water bath for 15 minutes. This aliquot, and an untreated one were given the base exchange treatment. An aliquot of each eluate was oxidized as usual with the potassium ferricyanide solution. The sample treated with sodium sulfite was used as the blank. The thiamine content thus determined was equal to 28 micrograms per 100 g. of canned mackerel flesh, which was comparable to the value determined by the rat growth method, and in the same range as those reported for other canned fish.

THE ANTI-THIAMINE FACTOR

The presence of a thiamine destroying factor in the flesh, and other organs of some species of fish became known because ranch-raised foxes fed raw fish suffered from a deficiency disease called Chastek's paralysis. The disease could

oftentimes be cured by feeding thiamine-rich concentrates, or by injecting large quantities of pure vitamin. It could be prevented by feeding a diet containing cooked fish, or by feeding raw fish on alternate days. The latter system of feeding permitted enough thiamine from the basal diet to be metabolized to prevent the development of symptoms.

The quantity of anti-thiamine factor present could be determined by adding a known quantity of thiamine to a suspension of a ground portion of the test sample. After incubating for several hours at room temperature, the solution was filtered, and the residue was washed. The combined filtrate and wash water was then assayed for thiamine.

It was found that the quantity of thiamine destroyed was dependent on the length of time the flesh was in contact with the vitamin. The destructive factor was easily destroyed by heat, and no thiamine could be detected in the cooked flesh of the fish containing the anti-thiamine factor.

Studies were begun to extract the active factor from carp, since fairly large specimens were readily available. The anti-thiamine factor apparently is concentrated in the viscera, although Green, et al (1942) reported that the head, skin, and fins contained a considerable concentration of this factor. The viscera of the carp were divided into three parts; namely, the spleen, the intestines, and the remainder of the viscera. These portions were finely chopped, and small samples were suspended in a two percent solution of acetic acid containing thiamine, for 18 hours at room temperature. After that period, a determination was made of the amount of thiamine that was destroyed. The incubation period which was arbitrarily selected was too long for a quantitative estimate of activity per gram of sample. It was definitely indicated, however, that the sample minus the spleen and intestines had less activity than the other two samples. This finding was confirmed by Sealock, et al (1943). They reported that an active preparation could be extracted with 10 percent sodium chloride.

In a preliminary experiment, an active preparation was obtained by extracting 320 g. of viscera with 10 percent sodium chloride, and making up to a final volume of one liter. The liquid was filtered from the solid material through cheesecloth. Ten ml. of this solution destroyed 170 micrograms of thiamine in one hour. This was roughly equivalent to 53 micrograms of thiamine per g. of viscera. The solution lost all activity when dialyzed against tap water. The addition of a small quantity of glacial acetic acid in order to attempt to precipitate the factor reduced the activity of the filtrate so only 12 micrograms of thiamine were destroyed per g. equivalent of viscera. Glacial acetic acid could probably be used to precipitate the active factor.

Later, it was deemed desirable to dialyze the extract against ammonium sulfate to precipitate the active fraction, which could then be reprecipitated with acetone. In the first test, the following molar concentrations were used: 1.39, 1.64, 2.05, and 2.60. The filtrates showed a progressively slight decrease in activity as the concentration of ammonium sulfate increased, except for the 2.60 molar concentration which showed a greater reduction of activity of the filtrate. The precipitates obtained from the 2.05 and 2.60 molar concentrations were dissolved

in water and tested for anti-thiamine activity. Neither exhibited any appreciable activity, but the precipitate from the 2.60 molar solution was definitely more active.

The dialysis was repeated with some of the same extract. The original solution had lost a great deal of its activity. Molar concentrations of 2.0, 2.5, and 3.0 were used. An inactive precipitate and an active filtrate was obtained with dialysis in a 2.0 molar concentration. An active precipitate and an active filtrate was obtained with the 2.5 molar concentration. An active precipitate and inactive filtrate was obtained with the 3.0 molar concentration. The activity of the precipitate was only slightly increased between 2.5 and 3.0 molar concentrations, but there was a great decrease in the activity of the filtrate in the latter concentration. These results were also obtained with a freshly prepared extract from carp viscera.

Two lots of viscera, 592 and 900 g., respectively, were extracted with sodium chloride, and the extracts were dialyzed against various concentrations of ammonium sulfate. The active precipitates obtained in the dialysis were, in some cases, dissolved in water and reprecipitated with acetone.

Table 3 - Data on the Extraction of the Anti-Thiamine Factor from Viscera of Carp

Molar Concentrations of Ammonium Sulfate	Yield of Wet Precipitate (from dialyzed filtrate)	Thiamine Destroyed Per Gram of Precipitate	
		½ hour	1½ hours
	Grams	Micrograms	Micrograms
First extract:			
2.0 to 2.4	1.7	-	143
2.4 to 3.0	2.5	165	-
Above 3.0	1.2	43	100
Fractionation of the precipitate obtained in 2.4 to 3.0 molar extraction:			
2.6		very weak	
2.8		-	69
3.0		-	113
Dialysis of another sample:			
2.0 to 2.4	1.4	68	-
2.4 to 3.0	1.1	135	
		160*	
Above 3.0	4.0	35	
		53*	
		80**	

The active precipitates were obtained by dialysis of extracts obtained with 10 percent sodium chloride solutions against ammonium sulfate solutions of given molarity. * and ** were active precipitates which were dissolved in water and re-precipitated with acetone. * was a wet acetone precipitate and ** was the dried acetone precipitate.

The data in Table 3 indicate that a partial concentration of the active material was effected. Due to the war conditions, it became necessary to begin work on problems of greater national importance so no further studies were carried out with the anti-thiamine factor.

SUMMARY

1. Of the samples tested, the thiamine content of shucked oysters varied from 100 to 190 micrograms per 100 grams.

2. Very little, if any, thiamine was found to be leached from shucked oysters by ordinary methods of handling before packaging.

3. Most raw fishery products contained from 50 to 200 micrograms of thiamine per 100 g. of edible material. This is about equivalent to the thiamine content of lean beef or poultry.

4. Comparatively few species of fish had the anti-thiamine factor in the edible flesh.

5. It was possible to partially concentrate the anti-thiamine factor by extracting carp viscera with a 10 percent solution of sodium chloride, and precipitating by dialyzing against a 2.5 to 3.0 molar concentration of ammonium sulfate.

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ULTRAVIOLET ABSORPTION CURVES FOR VITAMIN A USING TUNGSTEN AND HYDROGEN DISCHARGE LIGHT SOURCES

By G. Ivor Jones*

ABSTRACT

The spectrophotometric method for determining vitamin A potency has been generally adopted by the vitamin liver oil industry. The practice of using a tungsten light source for making measurements at certain wave lengths in the ultraviolet region, however, has not been considered reliable by the instrument manufacturer. To check on this, a series of experiments were conducted with two types of light sources. From the data obtained, it was concluded that reliable results may be obtained by use of the tungsten lamp.

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INTRODUCTION

The vitamin liver oil industry has generally adopted the spectrophotometric method of assay for determining vitamin A potency. Rapid adoption of this method was due mainly to the ease and rapidity with which vitamin A could be estimated in fish liver oils. Reproducibility of the results obtained with the spectrophotometric method was found to be much better than with methods previously used.

Although determination of vitamin A ordinarily depends upon the measurement of maximum absorption at 325 to 328 Mu., it is sometimes necessary to determine the absorption at 300 and 350 Mu. in order to properly evaluate the value obtained at 328 Mu. Ratio of the absorption at 300 Mu. to that at 328 Mu. along with the ratio of the absorption at 350 Mu. to that at 328 Mu. aids materially in deciding whether or not the reading at 328 Mu. is due entirely to vitamin A or due to the presence of appreciable quantities of non-specific absorbing substances.

Investigation has shown that vitamin A exhibits the following ratios when the whole oil is dissolved in ethanol or isopropanol: $\frac{E\ (300\ Mu.)}{E\ (328\ Mu.)}$ less than 0.73 and $\frac{E\ (350\ Mu.)}{E\ (328\ Mu.)}$ less than 0.65. These ratios were established as the minimum standards acceptable to the War Food Administration for the purchase of vitamin A oils and vitamin A concentrates by the Government. The now defunct WFA handled war period purchases of vitamin A oils and concentrates for Lend-Lease shipments, etc. War Food Administration standard requirements were specifically promulgated to obtain products of satisfactory quality and stability.

The Beckman Photoelectric Quartz Spectrophotometer, equipped with proper phototubes and accessories, is designed to operate with accuracy from 220 Mu. in the ultraviolet up to 1,100 Mu. in the infrared. A 6-volt, 25-watt tungsten lamp light source is satisfactory for measurements above 320 Mu. However, for measurements in the ultraviolet region below 320 Mu., it is stated by the manufacturer that a hydrogen discharge light source must be used. In addition, when the hydrogen discharge tube is employed, directions by the instrument manufacturer call for use of absorption cells of fused silica and a blue ultraviolet sensitive phototube with an ultraviolet transmitting envelope.

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Even though many of the vitamin laboratories equipped with the Beckman Spectrophotometer possess a hydrogen discharge lamp and its power supply unit, little use has been made of these accessories. Some of the reasons for lack of use of the hydrogen discharge light source for photometric measurements at 300 Mu. were: the comparatively short life of the early lamp models, the high cost of lamp replacement, difficulties with the power supply unit, and hesitancy on the part of the analysts to make the necessary instrument changes. As a result, most of the vitamin laboratories have apparently relied on the 300 Mu. measurements made with the tungsten light source even though this practice is not considered reliable by the instrument manufacturer.

In order to evaluate, critically, the practice of determining, with a tungsten light source, the absorption of vitamin A oils at 300 Mu. ultraviolet, a series of experiments were carried out using two different types of oil containing vitamin A. In one series, the light source used was the hydrogen discharge lamp. In the other series, the light source was the tungsten lamp previously described.

EXPERIMENTAL METHODS AND DATA

All measurements were made with a Beckman Quartz Spectrophotometer, Model DU, calibrated from 200 to 2,000 Mu. This instrument is equipped with a blue ultraviolet sensitive phototube with an ultraviolet transmitting envelope. This tube

Table 1 - Extinction Ratios Determined with Tungsten and Hydrogen Discharge Light Sources on Grayfish Liver Oil[1/]

Wave Length	Tungsten Lamp		Hydrogen Discharge Lamp		Wave Length	Tungsten Lamp		Hydrogen Discharge Lamp	
λ	E	$\frac{E\,\lambda}{E\,328}$	E	$\frac{E\,\lambda}{E\,328}$	λ	E	$\frac{E\,\lambda}{E\,328}$	E	$\frac{E\,\lambda}{E\,328}$
220	-	-	.780	1.452	300	.370	.685	.365	.679
230	-	-	.680	1.266	310	.470	.870	.467	.869
240	-	-	.570	1.061	320	.525	.972	.522	.972
250	-	-	.290	.540	325	.543	1.005	.538	1.001
260	-	-	.173	.322	328	.540	1.000	.537	1.000
270	-	-	.187	.348	330	.534	.988	.527	.981
280	-	-	.233	.433	340	.438	.811	.435	.810
290	-	-	.292	.543	350	.314	.581	.308	.573

1/Oil was dissolved in redistilled isopropanol.

has high sensitivity over the range 200-625 Mu. A second caesium oxide phototube with high sensitivity from 600-1,000 Mu. was part of the instrument's equipment.

Table 2 - Extinction Ratios Determined with Tungsten and Hydrogen Discharge Light Sources on Distilled Vitamin A Concentrate[1/]

Wave Length	Tungsten Lamp		Hydrogen Discharge Lamp		Wave Length	Tungsten Lamp		Hydrogen Discharge Lamp	
λ	E	$\frac{E\,\lambda}{E\,328}$	E	$\frac{E\,\lambda}{E\,328}$	λ	E	$\frac{E\,\lambda}{E\,328}$	E	$\frac{E\,\lambda}{E\,328}$
220	-	-	.186	.321	300	.362	.626	.361	.624
230	-	-	.165	.285	310	.482	.833	.475	.821
240	-	-	.140	.242	320	.552	.955	.550	.951
250	-	-	.123	.212	325	.577	.998	.575	.994
260	-	-	.120	.207	328	.578	1.000	.578	1.000
270	-	-	.134	.231	330	.570	.986	.568	.982
280	-	-	.182	.314	340	.474	.820	.470	.813
290	-	-	.259	.448	350	.333	.576	.333	.576

1/Concentrate was dissolved in redistilled isopropanol.

The tungsten light source consisted of a 6-volt, 25-watt tungsten filament lamp operated from a storage battery. The hydrogen discharge lamp was that fur-

nished by the instrument manufacturer and was operated from the hydrogen lamp power supply unit connected to the 110-volt, 60-cycle, alternating current house line. Samples of the oils were dissolved in redistilled isopropanol and fused silica absorption cells were used in making all photometric density readings.

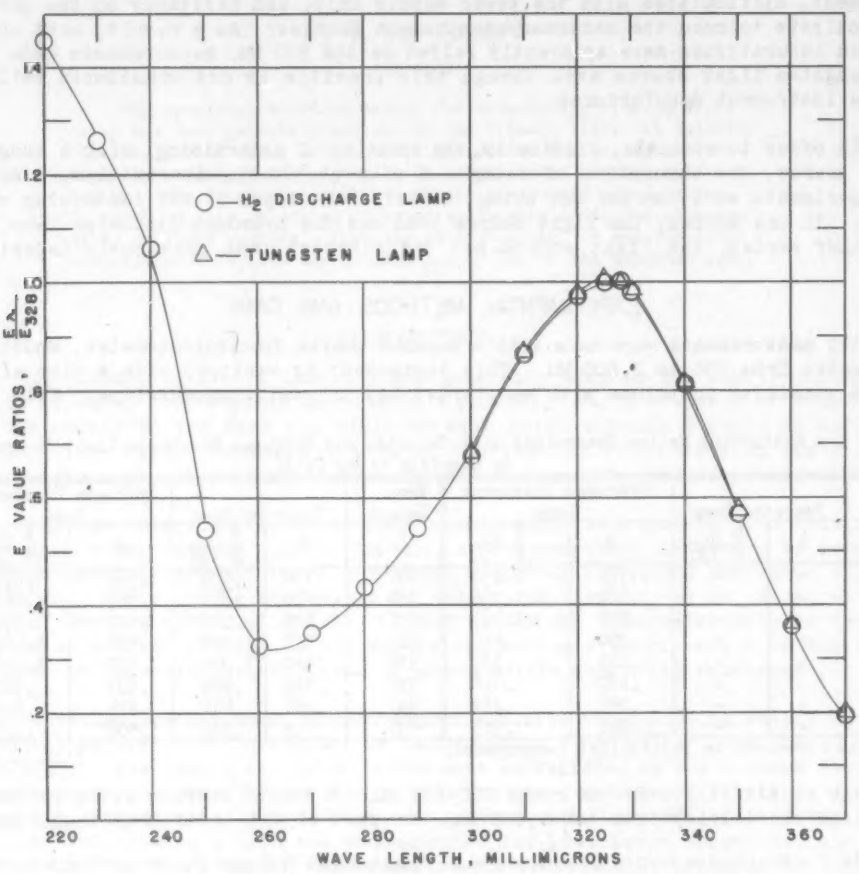


FIGURE 1 - ULTRAVIOLET ABSORPTION CURVES FOR GRAYFISH LIVER OIL

One of the samples used in the experiments was a commercially prepared grayfish liver oil (Squalus suckleyi) which had been held for approximately one year in refrigerated storage. The vitamin A content of this oil was in the medium potency range, being 18,400 units per gram. The other sample used was a distilled fish liver oil concentrate with a declared potency of 198,300 units per gram.

Photometric density readings were made at 325 Mu. and at 328 Mu., as well as at 10 Mu. intervals from 220 to 350 Mu. with the hydrogen discharge lamp and from 300 to 350 Mu. with the tungsten light source. Table 1 (see p. 23) presents ratios of extinction coefficients at a given wave length (E λ) to those at 328 Mu. (E 328) calculated from absorption readings using both light sources with grayfish liver oil. The ratios determined for the distilled vitamin A concentrate are given in

Table 2 (see p. 23). It will be noted that the ratios from 300 to 350 Mu. are practically the same with both light sources. This is more readily apparent from a graphic presentation of the data in the form of curves given in Figure 1 (see p. 24) and Figure 2. Some of the points on the curves for the different light sources used actually coincide.

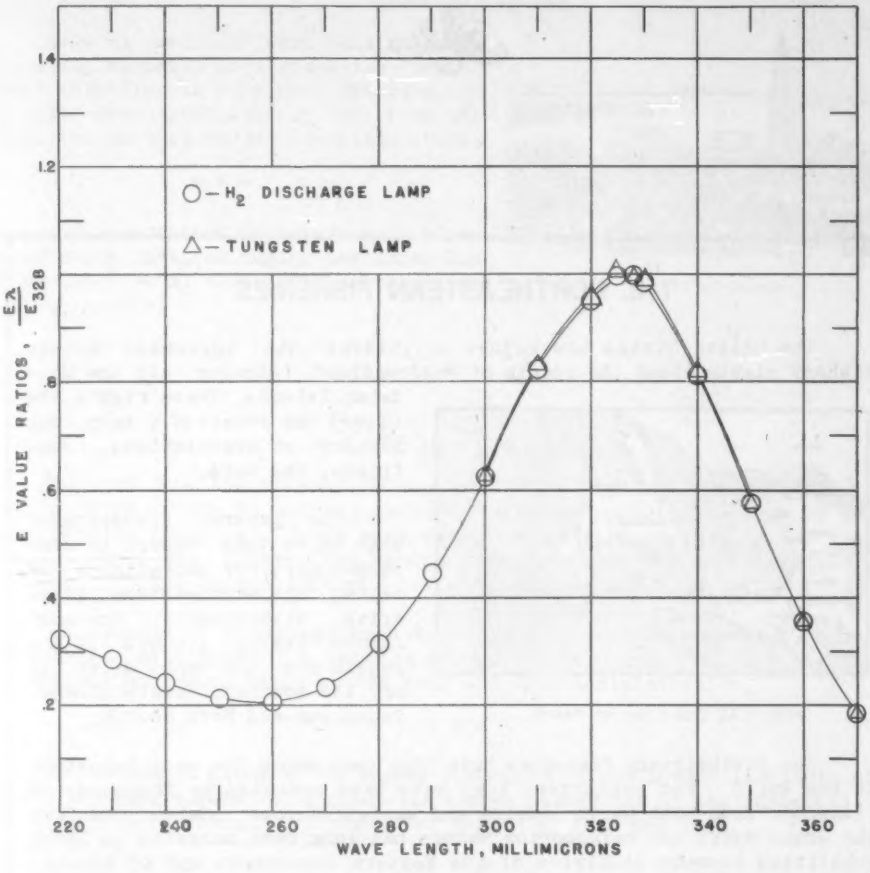


FIGURE 2 - ULTRAVIOLET ABSORPTION CURVES FOR DISTILLED VITAMIN A CONCENTRATE

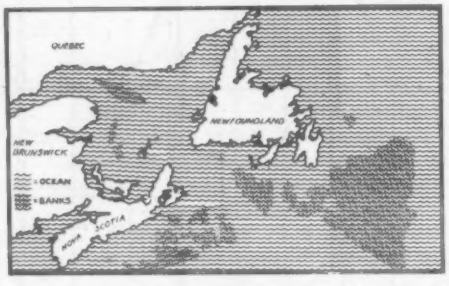
It was concluded from the data obtained with the two vitamin oils studied that the ratios $\frac{E\ 300}{E\ 328}$ and $\frac{E\ 350}{E\ 328}$ are as reliable when determined with the tungsten lamp as they are with the hydrogen discharge light source.

A comparison of the absorption curves below 300 Mu. for the two oils, Figures 1 and 2, indicates that the lower potency grayfish liver oil possesses considerable absorption below 260 Mu. in the ultraviolet while the curve with distilled vitamin A concentrate showed practically no absorption in this region. This may be due in part to the amount of oil in solution since concentration of the grayfish liver oil in the solution used for making the measurements was approximately 10 times that of the distilled concentrate because of the large difference in vitamin A

potency. This absorption in the far ultraviolet might also be due, in part at least, to substances other than vitamin A found in natural fish oils but not ordinarily present in a distilled vitamin A concentrate. Additional experiments upon other fish liver oils and composites would undoubtedly yield more information on which to base an explanation of these observations.

THE NORTHEASTERN FISHERIES

The United States now enjoys by international agreement certain fishery rights along the coasts of Newfoundland, Labrador, and the Magdalen Islands. These rights are in part the result of a very long history of negotiations, conflicts, and wars.



NORTHEASTERN FISHING BANKS

The general fishery area with which this report is concerned may, for convenience, be called the northeastern fisheries. Historically, the most famous fishing grounds in the region are the banks which lie off the southern coasts of Newfoundland and Nova Scotia.

The northeastern fisheries have long been among the most important in the world. For centuries, they have been operated by thousands of fishermen from both North America and western Europe. Salted cod from the Grand Banks and neighboring waters has long been marketed in large quantities in many countries of the Western Hemisphere and of Europe, and it is a particularly important food staple in the West Indies.

Compared with other economic enterprises, the northeastern fisheries were far more prominent in earlier times than they are now. Although fishing in this area has increased materially in recent decades, there has been a far greater expansion of agriculture, mining, and manufacturing on the North American continent.

--U. S. Tariff Commission, Report No. 152

TECHNOLOGICAL RESEARCH IN SERVICE LABORATORIES

JUNE 1947

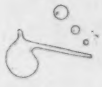
Boston, Mass.

Several meetings were held with cooperating agencies to discuss the "pepper spot" infection in sardines. Later schools of fish were substantially free from the infection, so the problem became less acute.

* * *

Three permanent employees were given termination notices during the month due to the anticipated substantial decrease in appropriations.

BOSTON HARBOR



College Park, Md.

The data from the freezer storage at 0° F. of packaged oysters show no difference in pH of liquid and organoleptic scores depending on type of treatment used prior to freezing. There were considerable differences in free liquor released. There was, however, no tendency for the quantity of free liquor to increase during the storage period.

The methods of treatment were spray washing with fresh water, and blowing in fresh and salt water for varying periods of time--all within the limits of the regulations promulgated by the Food and Drug Administration.

* * *

Staff members attended the annual convention of the Oyster Institute of North America in Asbury Park, N. J., and the annual conference of the Institute of Food Technologists in Boston, and presented papers at both meetings.

* * *

Several of the home economists attended the annual meeting of the American Home Economics Association at St. Louis, Mo., and supervised the Service's exhibition of fresh and processed fishery products.1/

* * *

A number of recipes, particularly of oysters, were kitchen tested during the month.

* * *

It was necessary to give termination notices to eight employees due to a decrease in appropriations.

1/See Cover, June 1947 issue of Commercial Fisheries Review.

Ketchikan, Alaska

Trial packs were prepared of smoked salmon spread.

* * *

Abalone meat and king salmon chunks were packaged and placed in freezer storage.

* * *

Samples of butter clams were collected at several locations, and extracts were tested for the presence of the toxic factor. Both toxic and non-toxic clams were found.

* * *

A cooperative project, concerning research on the economical utilization of salmon cannery wastes, with the Industrial Research and Development Division of the Department of Commerce and the Alaska Fisheries Experimental Commission, was begun. A staff was recruited from those who were terminated due to decreased appropriations for this and the Seattle Laboratory. Since the allotment of $47,600 for the cooperative project is limited to about six months, work is being started promptly on a full scale.

* * *

It was necessary to give termination notices to four staff members at this Laboratory.

Mayaguez, P. R.

Considerable information on sources of supply and marketing was given to establishments engaged in wholesaling and retailing fishery products.

* * *

During the month, four employees were given termination notices due to an anticipated decrease in appropriations for the fiscal year beginning in July. Active experimental work was scheduled to be stopped at the close of the month.

Seattle, Wash.

Considerable progress was made on extraction of oils from fish livers for analytical purposes. Apparently, the state of dispersion of the liver tissues in contact with the solvent is of great importance in obtaining maximum yield of oil.

* * *

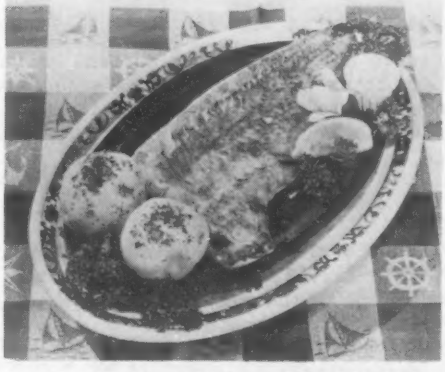
Arrangements were made and public showings were held of the new film "Filleting and Packaging Fish." The West Coast premiere was held at Astoria, Oregon,

and the film was shown later in the month at a large downtown Seattle moving picture theatre as a part of their regular program.

* * *

A number of the eight employees who received termination notices due to curtailed appropriations were hired temporarily by the Alaska Fisheries Experimental Commission to work on the cooperative project to develop economical utilization of salmon cannery wastes. Part of the work is being carried out in the Seattle Laboratory.

PLANKED WHITEFISH



3-or 4-pound whitefish, dressed
1½ teaspoons salt
1/8 teaspoon pepper
4 tablespoons butter or other fat
seasoned cooked vegetables (as desired)

If hardwood plank is used, oil well and place in a cold oven and heat thoroughly as oven preheats.

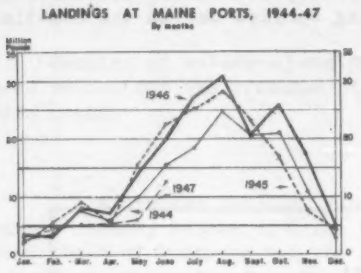
Clean, wash, and dry fish. Sprinkle inside and out with salt and pepper. Brush with melted fat. Place fish on the hot oiled plank or on a greased oven glass or metal platter. Bake in a moderate oven 400° F. for 35 to 45 minutes, or until fish flakes easily when tested with a fork. Remove from oven. Arrange two or more hot vegetables around fish. Garnish with parsley and lemon or tomato wedges. Serve immediately on the plank. Serves 6.

--Educational Leaflet 1

FRESH AND FROZEN FISH

New England

MAINE LANDINGS: Maine fishermen landed 12,938,000 pounds of fishery products, valued at $790,178, during June, bringing the total for the first six months of the year to 38,801,000 pounds, valued at $3,533,064, according to Current Fishery Statistics No. 362. This represents a decrease of 31 percent both in volume and value as compared with the landings during the first six months of 1946 which totaled 56,045,000 pounds, valued at $5,093,512.

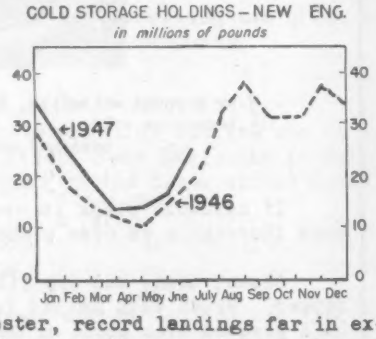


These decreases were due largely to the reduced landings of rosefish and the severe decline in the herring catch resulting from the blight which has affected large schools of these fish. Shellfish landings also were lighter than in the corresponding period of 1946, due primarily to decreases of 34 percent in the lobster catch and 96 percent in the sea mussel fishery.

The reduced landings do not necessarily portend an unsuccessful season for the Maine fishermen, inasmuch as 70 percent of the annual catch is normally taken during the last six months of the year. Seasonal increases in the herring, rosefish, and groundfish fisheries could result in the 1947 catch being nearly equal to that made during 1946.

* * * * *

COLD STORAGE: Holdings of frozen fish and shellfish in New England warehouses on July 1 amounted to 24,968,000 pounds, according to the Boston Fishery Market News Office. Compared with the preceding month and also with the corresponding month last year, this figure represented increases of 42 percent and 32 percent, respectively.

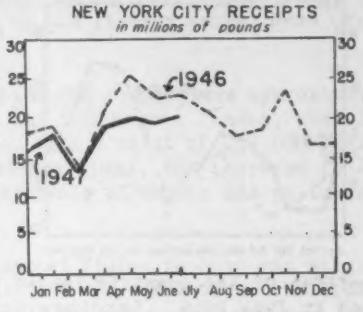


Boston warehouses, with holdings totaling 14,255,000 pounds, had 57 percent of the total. Gloucester had 17 percent of the total holdings for New England, while the rest of the cold-storage warehouses in the area accounted for the remaining 26 percent.

Although holdings in the warehouses of Boston and other New England points, exclusive of Gloucester, record landings far in excess of those on July 1, 1946, Gloucester's holdings are 21 percent less than on the same date last year. Gloucester's holdings, however, show the biggest percentage increase over those of June 1, 1947, amounting to 54 percent.

Middle Atlantic

NEW YORK CITY ARRIVALS: Receipts of fish and shellfish at Fulton Market during June 1947, totaled 19,760,000 pounds, according to the Service's Market News Office. This is a little more than three-quarters of a million pounds more than during May 1947. During June 1946, however, the total receipts were more than 22 million pounds.

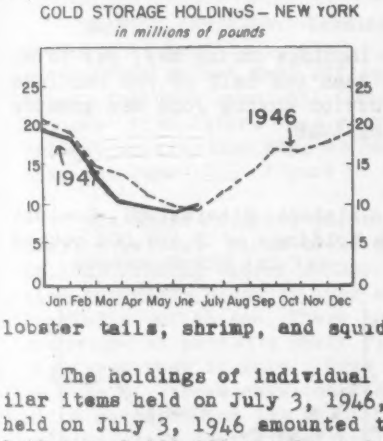


Of the June 1947 total, about 64 percent was fresh and frozen fish, and 36 percent, shellfish.

Leading items were flounder (blackback), mackerel, scup, whiting, salmon, cod, haddock, halibut, and yellowtails. Outstanding in the shellfish arrivals were hard clams, shrimp, sea scallops, lobsters, hard and soft crabs, and squid.

* * * * *

NEW YORK CITY COLD-STORAGE HOLDINGS: The holdings of frozen fish and shellfish in the New York metropolitan area on July 3, 1947, totaled 8,718,000 pounds, an increase of 4 percent when compared with the holdings on June 5, 1947, and a decrease of 11 percent when compared with the holdings on July 3, 1946, according to the local Market News Office.



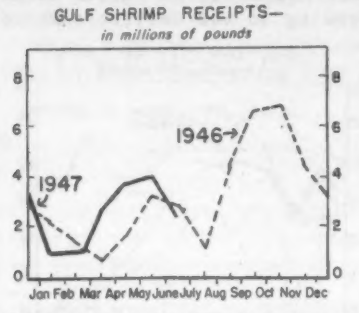
The holdings of salt-water species during June 1947 decreased 1 percent and fresh-water species, 7 percent, while shellfish items increased 68 percent. Important items included cod and haddock fillets, salmon, mackerel, and sablefish among salt-water species; carp, ciscoes, sturgeon, and whitefish in fresh-water fish; and lobster tails, shrimp, and squid in shellfish items.

The holdings of individual items as of July 3, 1947, when compared with similar items held on July 3, 1946, show some interesting comparisons. Cod fillets held on July 3, 1946 amounted to 2,387,000 pounds while those held on July 3, 1947 were 1,305,000 pounds, a decrease of about 45 percent. The reverse is true of haddock fillets--on July 3, 1946, 98,000 pounds were held in storage compared with 585,000 pounds on July 3, 1947. These changes reflect the decreased imports of cod fillets into the New York area and in the case of haddock fillets, the comparative abundance of this species in 1947 as compared with 1946, when the Boston fleet was tied up until June.

Gulf

PRODUCTION: Landings of shrimp during June for Alabama, Mississippi, Louisiana, and Texas as reported to the New Orleans Fishery Market News Office were 44 percent less than the previous month and slightly more than one-half of the quantity

landed in June of last year. During the first half of this year, landings were 30 percent less than for the same period in 1946. The closed season for the commercial catching of shrimp from inside and outside waters of Louisiana and Mississippi after June 10 is an important factor in accounting for the lower catch in June. Previous to this year, there was no closed season in outside waters. Louisiana inside waters were closed between December 15, 1946 and March 15, 1947. Last year, inside waters only in Louisiana were closed between March 15 and May 16, and between June 25 and August 12.



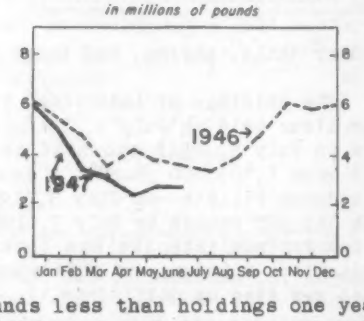
Oyster production has decreased, as is generally true during the summer months, however, small quantities were reported as being processed in June. This month's landings were approximately one-fifth of the quantity landed in May, and 36 percent less than the amount produced in June 1946. Landings during the first six months of this year were 37 percent greater than for the corresponding period in 1946.

Fish production of the salt-water varieties was greater, while that of the fresh-water varieties was slightly less in June than in May. From January to June, inclusive, landings of both fresh-water and salt-water varieties were greater than last year.

Blue crab production increased 24 percent over landings during May, yet total production so far this year is only slightly more than one-half of the landings during the same period last year. Crab meat production during June was greater than in May, but is much less this year than during 1946.

* * * * *

COLD STORAGE: Eleven cold-storage warehouses in Alabama, Mississippi, Louisiana, and Texas reported frozen fish and shellfish holdings of 2,618,000 pounds on July 3, 1947; 3 percent greater than four weeks ago, but 22 percent less than on July 4, 1946, according to the New Orleans Fishery Market News Office.



Frozen shrimp holdings on July 3 amounted to 785,000 pounds. During the previous four weeks the withdrawals exceeded the "in" movement by 262,000 pounds. On July 4, 1946, shrimp holdings were 1,159,000 pounds.

On July 3 of this year, salt-water fish holdings were 1,408,000 pounds; 218,000 pounds greater than four weeks earlier, but 437,000 pounds less than holdings one year ago. During the four weeks prior to July 3, withdrawals of Spanish mackerel, rosefish fillets, mullet, and small quantities of a number of other varieties exceeded the "in" movement.

Pacific

LANDINGS IN SOUTHERN CALIFORNIA: Total landings of market fish in June 1947 in the San Pedro-Santa Monica, San Diego, and Newport Beach areas of southern California were approximately the same as in May 1947, being only 5,000 pounds less than the 731,000 pounds landed in May, according to the Fishery Market News Office in San Pedro.

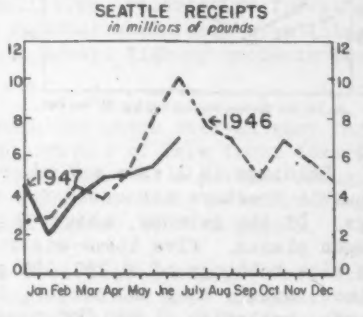
Arrivals at San Pedro-Santa Monica, totaling 469,000 pounds, were approximately 4 percent less; while San Diego landings, with 148,000 pounds landed, showed an increase of 54 percent. Newport Beach production, with a catch of 109,000 pounds, declined 25 percent from the May production. At San Diego, the increase in June over May was largely accounted for by increased arrivals of bonito and yellowtail, which were resold to canneries.

In general, production of most of the better market fishes in June was slightly better than in May, with increases in California halibut, rock bass, rockfishes, sculpin, sea bass, and smelt offsetting declines in barracuda and mackerel.

A comparison of landings in June 1947 with June 1946 would not be conclusive, since a price dispute in June 1946 heavily curtailed production.

* * * * *

SEATTLE ARRIVALS: Landings and wholesale receipts of fresh and frozen fishery products at Seattle totaled 6,624,000 pounds during June, according to the Service's local Market News Office. These receipts, which included over 451,000 pounds of miscellaneous fish livers and viscera were about 16 percent heavier than May, but nearly a third less than the June 1946 figure of 9,918,000 pounds.



The share dispute which had tied up the Seattle halibut fleet since the opening of the halibut fishing season on May 1 was finally settled toward the close of June and the local fleet hurriedly put to sea. These local vessels would not return to port with their first catches until the first week in July. Area II fishing closed on June 8, three days earlier than last year, which necessitated the much longer trip to the Area III grounds. Despite the belated start of the Seattle fleet, 12 trips totaling 155,000 pounds were landed at the local port during June by various units of the Alaska fleet and miscellaneous smaller craft. Additional truck, rail, and coastwise vessel shipments raised the halibut total to 2,058,000 pounds, less than half of the June 1946 halibut receipts. The average price received by the fishermen was 6 to 7 cents a pound higher than that of last year.

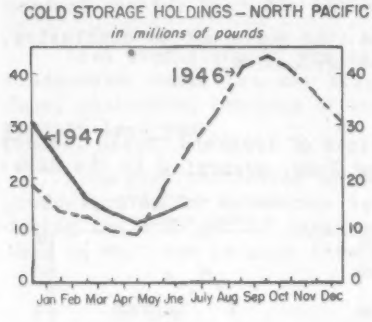
Otter trawl receipts of bottom fish were again substantially below normal and were responsible for a large portion of the month's decreased production. Compared with June 1946, when 154 trips delivered nearly 2½ million pounds, current trawl operations dropped to less than half with 1,107,000 pounds being landed in 67 trips. The bulk of these receipts were rockfishes and English and petrale soles.

Salmon fishing continued exceptionally active and catches were generally above normal. A total of 2,612,000 pounds was delivered to Seattle from all sources. This was more than two and a half times the amount received last year and about a million pounds heavier than that of May, of this year. The migrations of salmon, particularly kings, continued heavy and nearly 1¾ million pounds of this species were received during June. Of this amount, British Columbia imports accounted for nearly a million pounds. Prices paid for red kings ranged from 9 to 12 cents a pound higher than 1946 sales.

Nearly half of all receipts, or 3,107,000 pounds, were imports from British Columbia; 2,691,000 pounds were received from local sources; and the balance amounting to 826,000 pounds was received from Alaska. Total receipts of all fishery products for the first six months of 1947 amounted to 28,391,000 pounds, about 14 percent below the comparable 1946 figure of 33,160,000 pounds.

* * * * *

NORTHWEST COLD STORAGE: Stocks of frozen fishery products in 31 cold-storage warehouses of the Northwest region totaled 17,576,000 pounds on July 1, according to the Service's Seattle Market News Office. This was an increase of more than 3-1/3 million pounds over June 1 stocks. They were, however, 31 percent below the July 1, 1946 figure of 25,290,000 pounds.



The Seattle halibut dispute was settled toward the close of June and all vessels rushed to catch some of the halibut remaining in the Area 3 quota. Although Seattle receipts of fresh halibut were far below normal due to the long tie-up, nearly 1,648,000 pounds were received from various sources with about a fourth of this amount entering the local freezers.

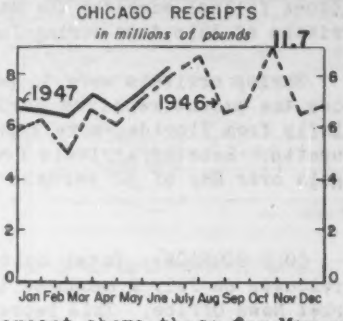
Holdings in Alaska and stocks of United States fish held in bond in British Columbia freezers accounted for about 59 percent of the Pacific Northwest holdings. Of the balance, about 33 percent was held in Washington and 8 percent in Oregon plants. Five items accounted for 92 percent of the total stocks. Halibut led with holdings of 9,357,000 pounds or 53 percent of the total, followed by salmon, mostly king and silver, 2,245,000 pounds; bait and animal food, 2,146,000 pounds; sablefish, 1,960,000 pounds; and fillets, 592,000 pounds.

Freezings during June totaled 6,424,000 pounds, about a million pounds more than May but less than half of the June 1946 freezings of 13,194,000 pounds. Nearly three-fourths of the current freezings was halibut. About a million pounds of salmon were also frozen of which 825,000 pounds were king salmon.

Cured stocks rose from 2,170,000 pounds to 2,680,000 pounds, a 24 percent increase over June and about 131 percent more than last year. Mild-cured salmon comprised nearly four-fifths of the cured fish stocks.

Great Lakes

RECEIPTS: Receipts of fresh and frozen fishery products in the Chicago wholesale market during June amounted to 8,146,000 pounds, according to the Service's Market News Office in that city. This total represented an increase of 8 percent compared with May's receipts and an increase of 4 percent over receipts for June 1946.



Fresh-water receipts rose 17 percent during June, due principally to increased arrivals of lake trout from Michigan and whitefish from Wisconsin. Arrivals of Lake Superior whitefish exceeded those of May by 30 percent and were 61 percent greater than the receipts of this species during June 1946. Lake trout receipts were 6 percent above those of May and 29 percent above lake trout arrivals during June 1946. Important arrivals of Manitoba yellow pike also added to the month's total. Yellow pike receipts were 24 percent above those for May and 53 percent greater than arrivals during June 1946. Shipments of "rough fish" (carp, buffalofish, sheepshead, etc.) from Iowa, Illinois, and Wisconsin were substantially above those during May.

Whitefish arrived in such quantities during the latter part of June that prices fell over 50 percent during one 3-day period, and on the first day of July, dropped to a low for the year of 12 cents with large lots selling at still lower prices. Dealers, equipped to utilize their own facilities, resorted to freezing as cold-storage warehouses tightened restrictions on acceptance of large quantities of fish for freezing. They were, however, willing to accept fishery products for storage.

Lake trout prices fluctuated throughout the month but never strayed very far away from an average of 32-34 cents per pound. Large arrivals of lake trout toward the end of June threatened to send the price downward, but arrivals slackened enough to prevent any drastic price change. Dealers, for a short period, were freezing most of their receipts but no great amount had to be handled in this manner.

Due to the long drawn-out negotiations on the West Coast, halibut arrivals fell 17 percent below arrivals for this variety during June 1946. Contrary to the usual custom, most of the halibut had its origin in British Columbia. Reason for this is the fact that Canadian fishermen took advantage of the U. S. halibut fleet tie-up to catch more than the ordinary amount taken by them. In June 1946, out of the 1,137,000 pounds of halibut arriving in Chicago, 697,000 pounds, or 61 percent, was U. S. caught. In June 1947, there were 947,000 pounds of halibut received in Chicago of which U. S. vessels caught only 279,000 pounds or 29 percent. Fresh halibut was at a premium during the latter part of June, and prices which had averaged around 24-27 cents during most of May rose to an average of 32-34 cents during late June. This situation also caused dealers concern over the prospects for frozen stocks of halibut, as most of the Area 2 catch was utilized in the fresh state.

Arrivals of salmon, chiefly king salmon, compared favorably with those during the corresponding month a year ago. There was some difference, however, in that most salmon supplies originated in British Columbia, with a good portion being of

the white king variety, an item that meets with little favor on the Chicago market.

Rosefish fillet arrivals, while comparable to those during May, were 41 percent below those for June 1946. Arrivals of cod fillets during June were comparable to those for last year but were 44 percent below arrivals during May. Haddock fillets exceeded the May arrivals by 142 percent and were 74 percent above arrivals of this item during June 1946.

Shrimp arrivals were 34 percent below the May total but they were 2 percent above the amount received during June 1946. Receipts of spiny lobster tails, chiefly from Florida, more than doubled May receipts as did scallops from Massachusetts. Lobster arrivals from Maine, Massachusetts, and New Brunswick showed a gain over May of 32 percent to reach the highest total of the current year.

* * * * *

COLD STORAGE: Total holdings of fishery products in Chicago cold-storage warehouses on July 2 amounted to 5,418,000 pounds, according to the local Fishery Market News Office. This represented an increase of 12 percent over the holdings on May 29. Compared with holdings on July 3, 1946, the amount represented a decline of 6 percent. Compared by items with holdings on May 29, fresh-water varieties showed a decline of 9 percent, salt-water items increased 18 percent, and shellfish and related items increased 35 percent.

Most important fresh-water items held, in quantity, were whitefish, lake trout, chubs, lake herring, catfish and bullheads, and smelt.

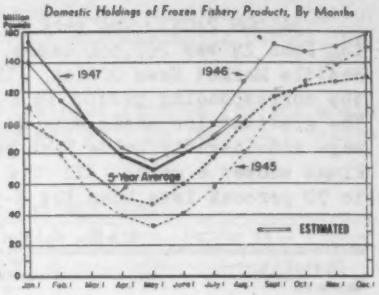
Frozen fillets exceeded those of May 29 by 6 percent and were the leading item in quantity among salt-water varieties. They were followed in importance by halibut, salmon, sablefish, whiting, and flounder.

Shrimp, as usual, was the leading item among shellfish, constituting 71 percent of the holdings of all shellfish and related items. Following shrimp in importance were scallops, spiny lobster tails, and squid.

It is safe to say that enlarged cold-storage facilities among fish dealers has had some effect upon the over-all totals of fishery products held in storage in Chicago. It was noted during the month of May, when the shrimp receipts were quite important locally, that the shrimp holdings in public cold-storage warehouses changed very little. Most dealers elected to hold most of their receipts in their own houses. This is true, to a certain extent, among fresh-water items. Large receipts of salmon and halibut from the Pacific Coast had not become evident, so it was too early to tell what effect an influx of these varieties would mean in the public cold-storage picture. It has also been noted that changes in the cold-storage holdings have been small and that normal seasonal increases have not occurred. At the time of the year's heaviest production, there have been weeks when withdrawals exceeded the receipts in local warehouses.

United States

COLD-STORAGE FREEZINGS AND HOLDINGS: Stocks of frozen fish and shellfish held on July 1st by firms reporting their activities to the Fish and Wildlife Service amounted to 90,158,000 pounds, compared with 97,806,000 pounds on the same date in 1946, according to information contained in Current Fishery Statistics No. 352. Holdings increased 10.4 million pounds during June, compared with an increase of 13.1 million pounds in the same month the previous year. As a result of the early closure of halibut fishing in the waters south of Cape Spencer, Alaska, and the low rate of the capture of halibut in the waters north and west of the Cape, stocks of halibut increased only 2.8 million pounds during June, compared with 7.5 million pounds in June 1946.



Data contained in this bulletin on the domestic freezing and holdings of frozen fishery products are based on reports from 213 plants. These are principally public cold-storage warehouses.

RETAIL FOOD PRICES AND TOTAL CONSUMER PRICE INDEX, UNITED STATES 1940-45 AND 1946-47 BY MONTHS
(INDEX NUMBERS 1935-39 = 100)

YEAR AND MONTH	MEATS 1/	EGGS	DAIRY PRODUCTS 2/	FATS AND OILS 3/	CEREALS AND BAKERY PRODUCTS	FRUIT AND VEGETABLES			SUGAR AND SWEETS	BEVERAGES	ALL FOODS	CONSUMER PRICE INDEX
						FRESH	CANNED	DRIED				
1940	96	94	101	82	97	97	192	101	97	92	97	100
1941	108	112	112	94	98	104	98	107	106	102	106	105
1942	126	136	125	120	105	133	122	136	126	122	124	116
1943	134	162	135	126	108	178	131	159	127	125	138	124
1944	130	153	134	123	108	177	130	166	126	124	136	126
1945	131	164	134	124	109	188	130	168	126	125	139	128
1946	161	169	165	152	125	191	141	190	144	140	160	139
JAN.	131	172	136	126	109	193	130	169	126	125	141	130
FEB.	131	144	137	125	110	193	131	170	127	125	140	130
MAR.	131	139	137	126	110	196	130	169	132	125	140	130
APR.	133	138	137	126	113	200	129	170	135	125	142	131
MAY	134	140	139	126	115	200	128	172	136	125	143	132
JUNE	134	147	148	126	122	197	128	172	136	126	146	133
JULY	174	161	179	138	126	202	131	176	138	126	166	141
AUG.	187	174	180	180	135	186	141	183	140	127	171	144
SEPT.	188	193	187	151	137	181	149	186	142	162	174	146
OCT.	191	215	202	148	138	179	155	199	168	166	180	149
NOV.	204	202	198	244	141	182	168	252	170	168	188	152
DEC.	198	201	201	207	142	181	173	268	175	176	186	153
1947												
JAN.	199	182	190	202	143	184	174	269	176	178	184	153
FEB.	197	170	183	201	144	189	173	270	178	183	182	153
MAR.	208	175	188	219	148	199	173	271	179	187	190	156
APR.	203	176	179	228	153	201	173	270	179	190	188	156
MAY	204	179	172	200	154	210	172	268	179	189	188	156
JUNE	217	183	172	188	155	208	170	263	180	181	190	157

1/ INCLUDES CHICKEN AND FISH. 2/ INCLUDES BUTTER. 3/ EXCLUDES BUTTER.
NOTE: INDEX NUMBERS FROM BUREAU OF LABOR STATISTICS AND ROUNDED TO THE NEAREST WHOLE NUMBER BY BUREAU OF AGRICULTURAL ECONOMICS.

THE NATIONAL FOOD SITUATION
--U.S. DEPARTMENT OF AGRICULTURE

CANNED AND CURED FISH

Salmon

SALMON PACK: The pack of Alaska canned salmon for the season to and including June 28 was 267,564 cases, according to the salmon pack report issued by the Seattle Market News Office. This was an increase of 31 percent over the pack for the corresponding period in 1946, but was 17 percent below the 5-year average. The greatest increases were made in the pack of kings and reds. Pinks and chums were considerably below last year's pack. Compared with the 5-year average, only kings showed a gain. All the other varieties showed decreases running from 15 to 70 percent less than the 5-year average for this period.

Alaska Salmon Pack to and including June 28, 1947

District	King	Red	Pink	Chum	Coho	Total
Western	-	531	-	-	-	531
Central	28,168	219,907	2,704	12,359	28	263,166
Southeastern	2,474	1,279	18	-	96	3,867
Total 1947, June 28	30,642	221,717	2,722	12,359	124	267,564
All districts--						
1946, June 29	19,580	159,931	5,708	19,023	13	204,255
1945, June 30	24,749	298,991	14,563	33,021	199	371,523
5-year average, June 30	25,931	258,714	8,839	29,417	145	323,046
Total pack, 1946	31,874	1,040,747	2,041,636	581,763	184,088	3,880,108
" " , 1945	42,514	1,177,523	2,239,643	689,001	201,790	4,350,471
5-year average	42,219	1,339,307	2,305,352	819,212	219,465	4,725,554

Shrimp

SHRIMP PACK: The pack of canned shrimp for the month of June amounted to but 9,166 standard cases, according to reports from canning plants operating under the Seafood Inspection Service of the U.S. Food and Drug Administration. Actually this figure represents the pack only until June 14, as the closed season for shrimp fishing in both the inside and outside waters of Louisiana began on June 10. It was to end on the first Monday of August.

Wet and Dry Pack Shrimp in all Sizes in Tin and Glass--Standard Cases*

MONTH		SEASON		
1947 June 1-June 30	1946 May 26-June 29	1946-47 July 1-June 30	1945-46 July 1-June 29	3-yr. average July 1-June 30
9,166	34,849	259,995	161,228	319,154

*All figures on basis of new standard case--48 No. 1 cans with 7 oz. per can in the wet pack and 6½ oz. per can in the dry pack.

The June total brought the total for the 1946-47 season, which ended with this month, to 259,995 standard cases. This was 61 percent greater than the total pack for the 1945-46 season but was 19 percent less than the average of the three previous seasons.

Tuna and Mackerel

TUNA AND MACKEREL PACK: California processors packed 601,771 standard cases of tuna during June, according to the California Division of Fish and Game. Percentagewise this total figured out in the following manner; 9 percent larger than the May pack, and 15 percent less than the pack for June 1946. The 6-month total of 2,168,125 cases, exceeded by 11 percent that for the corresponding period last year.

The only variety to show any consistency in the pack figures for the month was yellowfin. Compared with the packs for either May 1947 or June 1946, there is less than 1 percent difference.

California Pack of Tuna and Mackerel--Standard Cases*

Item	June 1947	May 1947	June 1946	Six mos. ending with June-- 1947	1946
	Cases	Cases	Cases	Cases	Cases
Tuna:					
Albacore	6,607	-	8,161	6,918	8,186
Bonito	16,544	629	789	29,345	5,039
Bluefin	2,612	5,369	89,586	52,919	160,200
Striped	79,575	59,244	64,687	262,316	168,604
Yellowfin	380,976	382,508	384,078	1,402,962	1,196,825
Yellowtail	7,942	3,629	1,322	18,427	24,537
Flakes	104,588	98,615	158,368	383,637	386,085
Tonno style	2,927	1,412	-	11,601	-
Total	601,771	551,406	706,991	2,168,125	1,949,476
Mackerel	1,398	764	1,196	216,933	54,909

*Standard cases of tuna represent cases of 48 7-ounce cans, while those of mackerel represent cases of 48 1-pound cans.

The pack of mackerel was 1,398 standard cases, according to the same source. Reversing the trend of the previous months, this figure represents an increase of 83 percent over the pack for May and is also 17 percent greater than the pack for June 1946. The total for 6 months is approximately four times as great as the 6-month total ending with June 1946. This follows the recent pattern whereby the cumulative total at the end of each of the preceding few months this year has been at least three times as great as the total for the corresponding period last year.

RESEARCH AND EDUCATION IN JAPAN

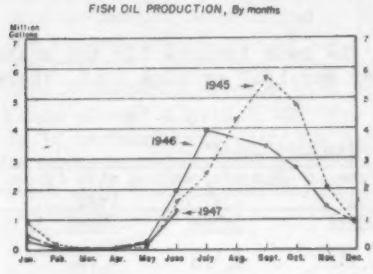
In keeping with the importance of marine products in the economy of Japan, much emphasis is placed on fishery research and education. Japan has 143 research stations, 32 prefectural schools, two colleges, and three departments in its imperial universities which deal with fisheries.

--Fishery Leaflet 249

FISHERY BYPRODUCTS

Oil and Meal

PRODUCTION: The production of fish oils in the United States and Alaska during June amounted to 1,336,251 gallons--32 percent below the yield during the same month in 1946, according to Current Fishery Statistics No. 360. During June, the production of meal by firms which normally produce 94 percent of the total yield of this product amounted to 21,542 tons--5 percent below the June 1946 yield. Reports that the current season's catch of menhaden has a low oil content are verified by the meal and oil yields which show that although the production of meal was 14 percent greater than in June 1946, the yield of oil declined 11 percent.



The total production of fish oils during the first six months of 1947 amounted to 1,950,505 gallons, compared with 2,847,274 gallons during the same period in 1946.

PRODUCTION OF FISH MEAL AND OIL, JUNE 1947

Fish Meal and Scrap

Product	June 1947	June 1946	Six months ending with June 1947 1/	Six months ending with June 1946	Total 1946 1/
Meal and scrap:	Tons	Tons	Tons	Tons	Tons
Groundfish	1,864	2,700	7,219	10,153	20,553
Herring, Alaska	-	1,960	-	1,960	14,989
Menhaden 2/	18,750	16,513	24,189	23,419	97,238
Pilchard (sardine)	-	-	3,163	5,727	34,500
Tuna and mackerel	928	1,604	5,178	4,743	12,256
Total	21,542	22,777	39,749	46,002	179,536

1/Preliminary data.
2/Includes a small quantity of herring meal produced in Maine.
Note: Data on the yield of fish meal and scrap are based on items which normally account for about 94 percent of the total production. Since cumulative totals are revised monthly, they may not agree with totals previously published.

Fish Oils 1/

Product	June 1947 2/	June 1946	Six months ending with June 1947 2/	Six months ending with June 1946	Total 1946 2/
Oil:	Gallons	Gallons	Gallons	Gallons	Gallons
Groundfish	20,656	40,821	33,107	93,871	301,136
Herring:					
Alaska	-	427,200	-	427,200	3,444,893
Maine	2,878	1,921	31,091	12,222	87,037
Menhaden	1,279,211	1,434,896	1,519,936	1,698,522	9,891,614
Pilchard (sardine)	-	3,800	148,919	429,087	4,741,689
Tuna and mackerel	21,086	32,445	155,788	100,415	367,667
Other	12,420	15,651	61,664	85,957	232,953
Total	1,336,251	1,956,734	1,950,505	2,847,274	19,066,989

1/Does not include the production of fish liver oils. 2/Preliminary data.
Note: Data on the production of pilchard and tuna and mackerel meal and oil in California were furnished by the California Division of Marine Fisheries.

OTHER FISHERY NOTES

Additions to the Fleet of U.S. Fishing Vessels

A total of 132 vessels received their first documents as fishing craft during June 1947, compared with 110 in the same month the previous year, according to information released by the Bureau of Customs, Treasury Department. The State of Washington led with 33 vessels documented during the month, followed by Florida with 17 vessels, and Louisiana with 10 vessels.

Vessels Obtaining Their First Documents as Fishing Craft

Section	June		Six mos. ending with June		Twelve Months
	1947	1946	1947	1946	1946
	Number	Number	Number	Number	Number
New England	10	6	41	31	86
Middle Atlantic	3	4	37	26	74
Chesapeake Bay	15	6	45	31	71
South Atlantic and Gulf	45	30	207	130	351
Pacific Coast	45	51	242	182	375
Great Lakes	5	8	36	37	76
Alaska	7	3	17	11	19
Hawaii	-	1	9	3	17
Unknown	2	1	7	10	16
Total	132	110	641	461	1,085

Note: Vessels documents by the Bureau of the Customs are craft of 5 net tons and over.

Alaska Hearings Announced

Secretary of the Interior J. A. Krug announced on July 21 a series of hearings to be held between September 19 and October 27 by the Fish and Wildlife Service to give Pacific Coast fishermen an opportunity to discuss proposed changes in the Alaska commercial fisheries regulations for 1948.

The hearings are scheduled as follows:

Juneau - Sept. 19	Petersburg - Sept. 26	Kodiak - Oct. 4
Sitka - Sept. 22	Ketchikan - Sept. 29	Cordova - Oct. 9
Craig - Sept. 24	Anchorage - Oct. 2	Seattle - Oct. 27

The hearings will be conducted by Seton H. Thompson, Chief, Division of Alaska Fisheries.

Conservation Zones

Progress toward establishment of conservation zones in Pacific and other waters, to protect salmon and other fisheries, has been suspended for the time being, Sen. Warren G. Magnuson was told by the State Department, according to a release of August 17, 1947.

The Department advised Sen. Magnuson of its "firm intention to resume attention to this highly important matter at the earliest possible opportunity."

It said that everything possible under present circumstances is being done to solve promptly and effectively the international problems of concern to the fishing industry.

State Department officials said it is believed that the "fisheries work has been so scheduled that there will be proper coverage of current problems of major significance to the fishing industry and that the Department can press forward on several of the most important long-range projects."

Sen. Magnuson had asked early consideration of the establishment of conservation zones, implementing the President's proclamation, off the West Coast of the United States and Alaska. He urged action on behalf of the important fisheries industry and cited suggestions that steps should be taken in anticipation of the pending Japanese treaty.

Food and Agriculture Organization

DIRECTOR-GENERAL ISSUES SECOND ANNUAL REPORT: The Food and Agriculture Organization of the United Nations on August 1 made public the second annual report of the Director-General to the FAO Conference covering the 12 months from June 30, 1946 to June 30, 1947. The report has been sent to the 48 Member Governments of FAO for their use in advance of the Conference, which will open in Geneva, Switzerland, on August 25.

The 42-page printed report outlines the growth of FAO from a newly-created body in the early stages of organization to a functioning agency that has begun basic work in a number of fields and has taken a hand in emergency and long-term international policy-making for food and agriculture.

In the publication, the Director-General reports as follows with respect to the Fisheries Division;

The Fisheries Division is being organized in three branches—Economics and Statistics, Technology, and Biology. Pending the appointment of heads of the last two, preliminary work on certain projects within their scope has been undertaken by the Director's office.

Work under way in the division includes the following:

Regional councils for the study of the sea. A proposal has been made to member governments for the establishment, by convention, of regional councils for the study of the sea in areas not now served by such bodies. The following regions have been suggested for consideration at Geneva: Northwest Atlantic, Southwest Pacific and Indian Ocean (Southeast Asia), Mediterranean Sea and contiguous waters, Northeast Pacific, Southeast Pacific, Western South Atlantic, and Eastern South Atlantic and Indian Ocean (African area). The functions of the councils would be to bring together existing data and recommend investigations by governments on a wide range of questions basic to full development of marine resources, such as distribution of species, seasonal variations in abundance, effect of fishing operations on numbers, and effective methods of propagation, stocking, disease control, and control of pollution. A draft constitution for such councils has been drawn up for discussion at the Geneva Conference.

Proposed Southeast Asia fisheries institute. In the Southeast Asiatic region most diets are lacking in protein, and in animal protein specifically. One of the most practical ways of correcting this deficiency lies in the development of sea and fresh water fisheries, which are generally recognized as capable of consid

erable expansion. However, if fish consumption is to be increased the methods of preservation must be much cheaper than those developed by western technology such as icing, freezing, and canning.

There seems a very good possibility of accomplishing this by paying more attention to the many methods of preservation now used by the native population, involving certain techniques of salting or drying and fermentation. In the Far East fish products of prolonged keepability and of special quality and flavor are obtained by these processes. Usually the methods are not fully understood by scientists, but there is reason to believe that some further research would make possible considerable development and innovation which could be closely related to the native customs and economies.

Such a project would need to be carried out in the region itself. Governments would no doubt regard the work as coming within their own responsibility, but it could be made much more effective if they were to pool their resources and facilities in a unified effort. This might be accomplished by organizing a Southeast Asia Fisheries Institute. Controlled and financed by co-operating governments, it would be charged with the developmental work in fishing methods and technology and might have attached to it a training school for native instructors who could serve governments in spreading the application of the new knowledge. FAO could assist in many ways in the setting up and functioning of such an institute.

Commodity studies. The division now has under way a comprehensive investigation and analysis of problems related to salted fish, the first of a series of such commodity studies to be used as a basis for possible recommendations to governments. An ad hoc Advisory Committee on Salted Fish, consisting of representatives from several of the more important producing and consuming countries, met in Washington in April. An interim report will be submitted to governments 15 July and a further report before the end of the year. Arrangements are being made for the co-operation of universities and national research institutions in basic studies connected with this and other commodity problems in fisheries.

Minimum standards of quality. Lack of uniform quality in fisheries products has been a serious impediment in international trade. Preliminary work looking toward the possible establishment of certain minimum standards has been undertaken in preparation for the Geneva Conference, where this question will be on the agenda.

1950 world census of fisheries. Preparatory work is being done on a 1950 world census of fisheries paralleling that for agriculture.

Development of common conversion factors and uniform methods of reporting. Lack of uniformity in reporting methods and conversion factors is a serious handicap to the presentation and use of fisheries statistics. Information is being collected and recommendations are being prepared which it is hoped will help governments to remedy this situation.

Statistics of landings, processing, and trade. Steps have been taken to collect statistical material directly from governments to augment published information, which is incomplete.

Yearbook of Fisheries Statistics. The first yearbook, containing comprehensive trade statistics from about 1930 to date, and production and utilization statistics for 1946 and the first half of 1947, will be published before the end of the year.

Quarterly Journal of Fisheries. This technical journal, the first issue of which will appear before the end of 1947, will contain quarterly statistics, articles on ichthyology, fisheries technology, and fisheries economics, and digests and reviews of significant material appearing elsewhere.

Monthly Bulletin of Fisheries. The monthly bulletin will be a medium for presenting current statistics and for keeping governments informed of new developments in the fisheries industry throughout the world.

Roster of technical workers and organizations. The division is assembling material for a world directory of fisheries technologists, biologists, and economists; governmental and other organizations concerned with fisheries; educational institutions offering specialized courses; and government projects for the education of fishermen in fishery techniques.

The following work is planned and will be begun as soon as possible: a catalogue of commercial fisheries resources; recommended nomenclature and synonyms for commercial fishes; establishment of a clearinghouse for periodic reports on research in the handling of fisheries products; survey of methods of fishing, with special emphasis on recent innovations; furnishing technical advice to member governments on establishment of statistical services.

Besides the fisheries section, the report contains additional material of general interest on FAO's program as well as a number of appendices which include the roster of Member countries, the members on various committees, and a listing of all FAO printed and offset publications.

The Director-General's Second Annual Report--C47/19--has been published in English and French and the Spanish edition is in preparation. The price in each language is 50 cents a copy. Pending arrangements with agents in various parts of the world, copies are obtainable from the Documents Office, Food and Agriculture Organization, 2000 Massachusetts Avenue, N. W., Washington, D. C.

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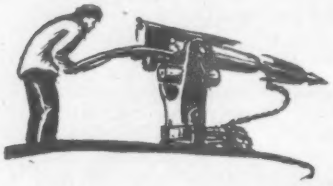
FATS AND OILS REVIEW: Total world supplies of visible fats in 1947 are estimated at 10.2 million tons as compared with 12.8 million tons prewar,[1] according to Fats and Oils Review--C47/11--July 21, 1947, prepared by the FAO staff as one of a series of documents designed to present background material in connection with the Third Session of the FAO Conference at Geneva, August 25. Indigenous production in continental Europe has declined by 1.5 million tons, while exports from the primary producing regions of Africa, Asia, and Oceania have declined by 2.1 million tons. These declines have been partially offset by an increase of over a million tons in United States production.

Table 1 - Export Supplies of Fats and Oils (1,000 metric tons, fat equivalent)

Types of Oil	Prewar	1945	1946	1947 Estimate
Marine Oils	645	95	181	339
Total Fats and Oils	2,109	645	820	720-1119

Prior to the last war, the whaling industry, primarily in the Antarctic, produced over 500,000 tons of whale oil. During the war, whaling virtually ceased. Most of the factory ships and catcher boats were converted to wartime purposes and many were destroyed. The few expeditions which it was possible to equip in time for the 1945-46 season encountered exceptionally unfavorable weather and oil production was disappointingly small at 145,000 tons. In the immediate prewar years, six or seven countries participated in this industry, the U. K., Norway, Germany, and Japan being the main producers. In 1946-47, it was possible to send out more expeditions, which this time made record catches per boat. Oil production reached 347,000 tons. As Germany and Japan are out of the picture with the exception of two controlled Japanese expeditions in 1946-47 producing 12,000 tons, the great bulk of the postwar production is controlled by Norway and Great Britain. As regards the final recipients, most European countries are obtaining less than before the war, while Germany is obtaining practically none (as compared with 200,000 tons annual prewar). The U.K. seems likely to receive two-thirds of this year's supply.



Despite the smaller fleet operating than in prewar years, the total number of whales caught approximates the maximum blue whale limit now prescribed under

1/ Because of the short-comings of available statistics, this figure and subsequent estimates for the world as a whole relate to total production in North America, Europe, Australia, and New Zealand, plus export supplies from the rest of the world; similarly, as regards consumption, the tables cover total consumption in the first group of countries mentioned plus the "consumption of imports" in the rest of the world.

the International Whaling Convention. It is planned to increase the number of expeditions this coming season which will pose the question of adjusting the limits of the catch to those allowed under the convention which was modified last year in view of the acute world shortage of fats and oils.

Table 2 - Visible Fats and Oils

Area	Prewar (old national boundaries)		1947 Estimate (new national boundaries)	
	Marine Oils (Excl. whale)	Total visible	Marine Oils (Excl. whale)	Total visible
	1000 Tons	1000 Tons	1000 Tons	1000 Tons
United States	103	3,072	84	4,460
Canada	14	226	5	266
United Kingdom	6	159	-	42
Australia	0	244	0	197
New Zealand	0	166	1	165
Continental Europe (excl. USSR):				
Northern & Western:				
Ireland	-	63	-	35
France	-	351	-	258
Belgium	1	94	-	48
Switzerland	-	33	-	25
Netherlands	-	134	-	66
Denmark	-	184	-	144
Norway	20	42	14	25
Sweden	-	91	-	105
Finland	-	48	-	22
Total	21	1,040	14	728
Central & Eastern:				
Germany - All Zones	14	889	-	400
Czechoslovakia	-	146	-	79
Austria	-	63	-	31
Poland	-	265	-	80
Total	14	1,363	-	590
Danubian Countries	-	422	-	264
Southern Europe:				
Italy	1	451	-	276
Spain	-	450	-	470
Portugal	-	86	-	80
Greece	-	127	-	99
Total	1	1,114	-	925
Total Continental Europe	36	3,939	14	2,507
Grand Total	159	7,806	104	7,534

Note: Total production in Europe (excl. USSR), North America, Australia, and New Zealand in metric tons, fat equivalent.

World production of fish oil, other than whale oil, is relatively small but not at all negligible. The United States' production of herring oil (includes oil produced from sea herring, menhaden, pilchard and related species) in 1946 amounted to about 63,000 tons compared with about 80,000 tons in the previous year and more than 100,000 tons in 1939. Norway produced about 15,000 tons of herring oil in 1946 compared with 19,000 tons in 1939 and 25,000 tons in 1940. Iceland produced about 17,000 tons of herring oil in 1946 compared with about 20,000 tons[2/] annually in the late '30's and some 25,000 tons[2/] during the war years. Canada's production of herring oil in 1946 amounted to about 4,000 tons. Newfoundland's production was very small. Japan is no longer operating her fishing industry concessions of Siberia and her catch from coastal waters is now required primarily for direct food consumption. The Japanese herring oil production in 1946 slightly exceeded 3,000 tons.

2/Export figures.

The total production of herring oil by these countries amounted to about 100,000 tons in 1946, still below the prewar level. As only a small proportion is refined for human consumption, it has been proposed that more attention should be devoted to refining.3/

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NILS JANGAARD ON STAFF IN ROME: The Food and Agriculture Organization of the United Nations announced on July 22 the appointment of Nils Jangaard, fisheries attaché of the Norwegian Embassy at Washington, to the staff of the FAO Fisheries Division. Mr. Jangaard left by plane on July 22 for Europe where he will represent the Fisheries Division at the FAO Temporary European Office at Rome. The Government of Norway granted Mr. Jangaard a leave of absence for a year to serve on the FAO staff in response to a request by Sir John Boyd Orr, Director-General of FAO.

Fisheries in Europe present some difficult problems of distribution and marketing. These were the subject of discussion of a committee of fisheries experts from the main producing and consuming countries of Europe meeting recently in Rome. Mr. Jangaard will pay particular attention to the recommendations of this committee, and will work closely with the FAO National Committees through the Temporary European Office.

Mr. Jangaard, who is one of Norway's leading fisheries experts, has represented his government in North America since 1941. He was Norwegian Vice Consul at Halifax, Nova Scotia, from 1941 to 1944. For the last three years, he has been fisheries attaché of the Norwegian Embassy at Washington. Mr. Jangaard has 20 years' experience in the fishing business including 5 years in the fisheries and shipping business in Portugal, and a year as Secretary of the Norwegian Legation at Rio de Janeiro. He speaks several European languages.

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QUALITY STANDARDS: In the following Memorandum to Member Governments dated July 14, FAO presents further considerations with respect to an international code of quality standards.

In the report of the First Session of the Conference (Quebec, 1945) it is stated that lack of standardization of quality, packaging, weight, and designation of fish commodities constitutes a restriction to trade. The object of this memorandum is to supplement the Memorandum to Member Governments, C/P3 of 6th May 1947, which has already been circulated, and in which Member Governments were informed that it is proposed to initiate preliminary discussions on the desirability of an international agreement upon minimum standards of quality for certain fisheries commodities.1/

3/In addition, the medicinal liver oils occupy an important place in human diet. In 1946, the United States produced about 2,000 tons of medicinal oils; Iceland, 6,000 tons; Canada, 1,000 tons; Newfoundland, 2,000 tons; Norway, 12,000 tons. The total for these countries for which records are available amounted to 23,000 tons. Some technical oil may be included but the bulk is presumably medicinal oil. The vitamin A content of the United States production is computed as 56 trillion international vitamin units. For the other countries, conversion of vitamin units is not available. The preponderant part of the United States' vitamin A production from fish oils came from shark liver which is a recent development. Other countries; e.g., South America, South Africa, India, etc., are conducting shark liver fisheries but no statistics are yet available.

1/See "Minimum Standards of Quality," Commercial Fisheries Review, May 1947, pp. 41-42.

The question before the Conference at this time is as to whether they approve in principle of such an international agreement upon minimum standards of quality.

If the Conference agrees to this principle, it should give consideration to the preparatory steps towards the accomplishment of such a purpose. It would seem that these would involve:

1. The selection of commodities to be affected, which is a question that might best be dealt with by those versed in trade;

2. The choice of the standards of quality to be defined by the code, which is of concern to the scientific experts and technologists.

The Conference may wish to refer consideration of these complicated questions to Ad Hoc Committees nominated by governments, who could work with the Fisheries Division, and would present reports to the next Conference.

In the meantime, the following considerations are offered:

Commodities Chiefly Concerned

The commodities chiefly concerned are those entering into international trade. Statistics reveal that these are canned fish, salted cod and codlike fish, salted and pickled pelagic fish, bloaters and red herring, and fish meal and oil. It is not possible to accurately determine the position of frozen and fresh fish in international trade, since these products are not separated in the statistical reports.

The Nature of the Code

The nature of an international code of standards of quality for fisheries products would be such as to define those attributes of quality which are regarded as a minimum requisite for the product concerned. Some of these attributes can be objectively measured. Others cannot. It is possible to detect the presence of putrefactive bacteria, or those harmful to the human organism by objective means. Similarly color, texture and mixture of solids and liquids and their analysis, weights and form of package also lend themselves to objective measurement. But quality includes taste, smell and visual appeal, the measurement of which presents a much more difficult problem, and one which is usually dealt with by subjective means. Considering the great variety of products, each of which would require a separate description, it is suggested that it may be difficult to arrive at a code which can adequately deal with all the attributes of quality. Chances of success would be greater if attention were focussed upon the relatively few attributes of quality that can be objectively measured, and of these to choose only those, the absence of which constitutes a barrier to consumption or are actually harmful to the consumer.

It is recognized, as has been pointed out in the former memorandum that the existence of an international code of standards of quality brings no compulsion to either producing or consuming countries to adopt it or to enforce adherence to its provisions. Such enforcement would pose an administrative problem of some difficulty to certain exporting countries. On the other hand, importing countries might, by insistence that imported commodities conform to the provisions of the code, bring about its application.

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REGIONAL COUNCILS: On July 17, the Food and Agriculture Organization of the United Nations sent an additional memorandum to Member Governments on Regional Councils entitled "Further to the Proposal to Establish Regional Councils for the Study of the Sea." The memorandum--C47/30--is reproduced herewith.

FOOD AND AGRICULTURE ORGANIZATION

OF THE UNITED NATIONS

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

Memorandum to Member Governments

Further to the Proposal to Establish Regional Councils for the Study of the Sea

A memorandum to Member Governments entitled "Proposal for the Establishment by Convention of Regional Councils for the Study of the Sea", C/74, 7th May 1947, has been circulated. In this it was indicated that further to the proposal, a draft Convention, which might be suitable for the establishment of such Councils for the Study of the Sea, would be circulated to Governments for consideration at the forthcoming conference.

This is now done in the form of a proposed draft Constitution for Regional Councils for the Study of the Sea, attached hereto, which may be suitable as a starting point in the derivation of an instrument of establishment when such matters are considered by interested Member Nations in the various regions. It is intended to present certain ideas which, if they are approved, can be put into proper form by legal draftsmen.

If the Conference approves of the principle of establishing such Regional Councils under the auspices of FAO, the Conference may wish to recommend that action be taken to initiate discussion amongst Regional Groups of Member Nations after the Conference has ended.

No Existing Rights Abridged

The memorandum C/74, referred to above, considered various regions from the global point of view in order to achieve provisional delimitation. It cannot be emphasized too strongly that the limits suggested for the several regions are for the purpose of indicating possible zones of maximum interest and that they do not in the least abridge the rights of nations, individually or collectively, to conduct investigations anywhere on the high seas in any part of the world which in any case they are entitled to do under International Law.

On the other hand, it is to be expected that there will be, on occasion, a desire on the part of one Regional Council to conduct, or see conducted, scientific investigations in the home waters of another, and this desire should not be repugnant to anything explicitly or implicitly expressed in the proposed Constitution.

Relation of Similar International Institutions

It was also pointed out in memorandum C/74 that the proposal aims at the establishment of Regional Councils for the Study of the Sea in parts of the world not now actively served by such bodies. Notable amongst existing bodies of this nature is the Permanent International Council for the Exploration of the Sea with its Headquarters at Copenhagen, Denmark. This Institution was founded in 1899 under a renewable five-year agreement between the Governments of Belgium, Denmark, Finland, France, Great Britain, Iceland, Ireland Netherlands, Norway, Poland, Russia, Spain and Sweden. Its purpose is to secure international cooperation in scientific inquiry on the high seas. Its field of action has been largely in the North-eastern parts of the Atlantic, the North Sea and the Baltic Sea, in which waters it has been responsible for much of the pioneer work in the promotion of fisheries research. It collects, collates and publishes statistics of the landed sea fish in Europe, maintains certain physical and chemical standards for reference at Copenhagen, and conducts certain work in hydrography.

No proposal is made for the establishment of a Regional Council for the European waters thus served by the ICES.

Institutions that are inactive so far as is known at the moment are :

1. The International Commission for the Scientific Exploration of the Mediterranean - which was founded at Madrid in 1919, and included Delegates from Egypt, Spain, France, Greece, Italy, Monaco, Tunis and Turkey. According to present information the Commission is now inactive.

2. The North American Council on Fisheries Investigations - which was organized in 1920 under an informal agreement between the United States of America, Canada, Newfoundland and France. The Council met infrequently and held its last meeting in 1956

3. International Committee on Oceanography of the Pacific - which was suggested in 1923 at Sydney, and included Australia, Canada, China, France, French Indo China, Great Britain, Japan, Netherlands, Netherland East Indies, New Zealand, Philippine Islands, USSR and the United States of America. So far as is known this Committee was never convened.

4. Consejo Oceanografico Ibero-Americano - which was organized in 1929 under an agreement signed by Argentina, Costa Rica, Ecuador, Salvador, Spain, Guatemala, Mexico, Panama, Peru, Dominican Republic and Uruguay. The period of agreement was for eight years and it is not known whether it has been renewed.

The regional Councils now proposed cover the waters formerly served by these now inactive Councils on the grounds that there is evident need for the services proposed and that most of the countries who were members of the above institutions are now members of FAO, who, through its Fisheries Committee, particularly at the Quebec and Copenhagen Conferences, requested that action be taken towards the establishment of such Regional Bodies.

Fisheries Institutions founded by Treaty

Agreements exist in the form of treaties between the United States of America and Canada creating the International Fisheries Commission for the preservation of halibut in the North Pacific and Bering Seas; the International Pacific Salmon Fisheries Commission for the development and conservation of Pacific salmons; and the Great Lakes Fisheries Board for the conservation of fisheries in the Great Lakes of North America.

These bodies are charged with the duty of making investigations and recommendations, based upon the findings, on the control of fishing.

They differ from the proposed Regional Councils in that they are bilateral, they maintain staffs of scientists to investigate specific problems defined by treaty; they, in effect, formulate regulations governing fishing.

Regional Councils which are more general in their scope of interest could exist collaterally with such bodies. There would probably be close cooperation between them, and they would no doubt be represented upon the Councils as observers.

Technical, Administrative and Financial Implications

A report on the technical, administrative and financial implications of the proposal may be of interest.

Technical - Regional Councils are intended to be deliberative coordinating bodies which will formulate problems concerning the maximum utilization of fisheries resources of the sea, assemble and correlate existing information and to point to gaps in knowledge. Actual research conducted in any region will be controlled, financed and performed by Member Governments, but it is hoped that the deliberations of a Council may lead to suggestions on the most useful orientation of such work.

The technical implications of the Councils per se will therefore be limited to making reports, and the publication of such data as the Council may decide upon. It is expected that FAO, through its Headquarters or Regional Offices, when they are established, will be able to provide the necessary technical services in this connection.

If a Council decides to undertake research, or the supply of services under its own supervision and direction, the Council would be expected to reach an agreement between its Members to make such an arrangement possible, and the technical implications of this action would be the responsibility of the Council.

Administration - It is provided in the proposed Constitution that the Council shall elect a Chairman, Vice-Chairman, and that it may elect an Honorary Secretary who, together with the Executive Secretary, appointed by FAO from its own staff, will constitute the administrative officers. The routine secretarial and office work will be conducted by the Executive Secretary, who will usually be attached to the FAO Regional Office and could therefore avail himself of the clerical assistance necessary.

Financial - The proposed Constitution provides in Article IV that -

"1. The expenses of the representatives at the Council, and of its experts and advisers, occasioned by meetings of the Council, shall be determined and paid by their respective Governments.

"2. FAO shall be responsible for the expenses involved in communications, secretarial work, and publications within the limits of an annual budget which shall be prepared in accordance with the established regulations of FAO and approved in conformity with existing procedure of FAO.

"3. The annual budget may include provision for travelling and living expenses of the Chairman, and Vice-Chairman, when the work of the Council in the intervals between its meetings requires them to be away from their respective headquarters. Such expenses shall be determined and paid by FAO according to its established regulations."

The expenses involved will therefore be mainly those concerned with publication and travel.

Publication - The precise form and arrangements for publication will be subject to consultation between the Council and FAO who, as pointed out above, will supply the technical service needed. It is thought that a uniform method of reporting and publication will be worked out, but some time will elapse before the volume of printed material becomes significant. Once the Councils are well established it is estimated that from two to four thousand dollars per annum per Council may suffice.

1947 Fur-Seal Take Announced

A total of 61,447 fur-seal skins were taken in the Government-administered sealing operations on Alaska's Pribilof Islands during the 1947 season which closed July 31, Secretary of the Interior J. A. Krug announced on August 17.

This represents a decrease of 3,276 skins from the 1946 take, due, according to officials of the Fish and Wildlife Service of the Department of the Interior, in part to the earlier termination of sealing operations. The take of seals is confined to the young males which early in the season are segregated from the rest of the herd. As soon as these young males begin to mingle with the family groups, it is customary to discontinue sealing to avoid injury to the females and young.

The seal herd numbered 3,613,653 animals when the annual census was taken early in August, Secretary Krug stated. This is an increase of 6.72 percent over the 1946 census of 3,386,008 animals.

ALASKA FUR-SEAL

Fur-seals, which have a soft and beautiful underpelage, are highly valued and the Pribilof Island herd is estimated to be worth in excess of $100,000,000.

When the Federal Government assumed active management of the fur-seals in the Pribilofs in 1910, the herd contained only 132,279 animals. By careful conservation, the herd has been developed to its present size and, at the same time, has produced nearly a million and a half skins which have been sold for the account of the Government.

The North American fur-seal herd comprises about 80 percent of all the fur-seals in the world. Smaller herds are found in the western Pacific off the coast of Uruguay, and off the Cape of Good Hope.

The main breeding grounds of the North American fur-seals are St. Paul and St. George Islands, the largest of the Pribilof group. From wintering grounds extending as far south as southern California, the entire herd assembles each spring on these treeless, volcanic islands. Here they remain for several months, during which the young seals, or pups, are born.

Halibut Areas Closed

Under authority of the Convention between the United States of America and the Dominion of Canada for the preservation of the Halibut Fishery of the Northern Pacific Ocean and Bering Sea, and as provided by regulations effective March 17, 1947, the International Fisheries Commission announced on July 24, 1947, that the closed season in Area 1A, Area 3, and Area 4 would begin at 12, midnight, of the 17th day of August.

This terminated all halibut fishing on the Pacific coast of Canada and of the United States, including Alaska, until after the end of the closed season as defined in the said regulations.

Under the provisions of the aforesaid regulations, permits for the retention and landing of halibut caught incidentally to fishing for other species with set lines in any area will become invalid at 12, midnight, of November 15th.

Salmon Waste

Research on the possibility of establishing a year-round industry for processing the waste products of Alaska salmon canneries will be undertaken by the Alaska Fisheries Experimental Commission under a contract with the Office of Technical Services, Department of Commerce, John C. Green, OTS Director, announced on August 4.

ALASKAN SALMON CANNERY

Funds amounting to $47,000 have been allotted for the research by the Industrial Research and Development Division of OTS. The project will undertake to determine the specific constituents in salmon waste which have potential market value and the best method for storing the waste for year-round processing.

Approximately 30 percent of the annual salmon catch of 360,000,000 pounds is waste material. This waste contains many recoverable pharmaceuticals such as vitamins, hormones, and amino acids, and chemical raw materials used as drying oils and resin bases, Mr. Green explained. Recoverable material is estimated by experts to be worth from $5,000,000 to $10,000,000 annually. The waste, now being dumped into the sea or allowed to rot at the canneries, includes the head, collar, tail piece, liver, milt, roe, and other offal.

Fishing is Alaska's largest industry and its products are valued at more than twice the total for minerals, the Territory's next most important industry. Salmon accounts for 90 percent of the value of fish products. About 30,000 persons, of whom only 7,000 are residents, are employed during the fishing season.

Establishment of byproducts plants would not only aid Alaskan fish canneries, but would also provide additional year-round work in the Territory, Mr. Green said. Utilization of the waste would also provide greater conservation of fish resources.

The Fish and Wildlife Service of the Department of the Interior is cooperating with the Alaska Fisheries Experimental Commission in the technical aspects of the

project and the Alaska Committee of the Department of Commerce is cooperating in the economic aspects.

Import Requirements of the U.S. Food, Drug, and Cosmetics Act

A booklet entitled Import Requirements of the United States Food, Drug, and Cosmetics Act was recently issued by the Food and Drug Administration. The purpose of the publication is to convey information on the Federal Food, Drug, and Cosmetic Act that will be helpful to foreign manufacturers and exporters and to United States importers who may not be fully familiar with the requirements of this United States law.

In addition to a discussion of the principal requirements of food law, individual foods are treated under different categories. There is a section devoted to seafoods. Under this category, regulations pertaining to canned fish, fresh and frozen fish fillets, caviar and fish roe, and other seafood products are outlined.

Copies of the publication may be obtained from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. The price is 15 cents.

Wholesale and Retail Prices

The food bill for moderate income families in large cities was essentially stable between April 15 and May 15, as the regular monthly survey by the Bureau of Labor Statistics of the U. S. Department of Labor showed a slight decline, averaging 0.2 percent. Lower prices for fats and oils and dairy products more than offset increases for fruits and vegetables, eggs, and meat.

Wholesale and Retail Prices

Item	Unit		Percentage change from--	
Wholesale: (1926 = 100)		May 17,1947	Apr.19,1947	May 18,1946
All commodities	Index No.	147.0	-0.1	+32.6
Foods	do	161.1	-0.7	+44.5
Fish:		May 1947	April 1947	May 1946
Canned salmon, Seattle:				
Pink, No. 1, Tall	$ per doz. cans	3.066	0	+55.6
Red, No. 1, Tall	do	5.486	0	+48.5
Cod, cured, large shore, Gloucester, Mass.	$ per 100 pounds	13.50	-6.0	0
Herring, pickled, N. Y.	¢ per pound	12.0	0	0
Salmon, Alaska, smoked, N. Y.	do	35.0	0	0
Retail: (1935 = 100)		May 15, 1947	Apr.15,1947	May 15,1946
All foods	Index No.	187.6	-0.2	+31.6
Fish:				
Fresh and canned	do	255.1	-2.3	+16.9
Fresh and frozen	¢ per pound	37.4	-4.3	+ 3.0
Canned salmon:				
Pink	¢ per pound can	40.4	+2.4	+64.0
Red	do	61.8	+2.1	+42.1

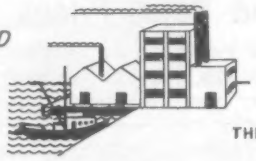
Fresh and frozen fish prices declined 4.3 percent during the month to an average price of 37.4 cents per pound. The index for fresh and canned fish at 255.1 was 2.3 percent below the index for April 15 but up 16.9 percent from the index of a year ago.

Canned salmon reversed the general downward trend. Pink salmon at 40.4 cents, per pound can, was up 2.4 percent from a month ago and 64 percent higher than a year ago. Canned red salmon also showed increases compared with a month and a year ago.

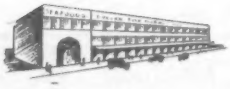
Estimated Value of Fish and Fishery Products at PRODUCTION, PROCESSING, and DISTRIBUTION Levels* 1946

THE *ORIGINAL* VALUE OF FISH AND SHELLFISH AS TAKEN FROM THE WATERS WAS **$253,000,000**

WHEN *PROCESSED*



THE VALUE WAS **$528,105,000**



AFTER *WHOLESALE* DISTRIBUTION THE VALUE WAS **$688,697,000**

AND WHEN *RETAILED* TO THE CONSUMER

THE VALUE WAS **$887,791,000**

* Based on statistical data obtained by Fish and Wildlife Service and Federal Trade Commission

FOREIGN FISHERY TRADE

Imports and Exports

GROUNDFISH IMPORTS: Imports of fresh and frozen groundfish (fillets, steaks, etc., of cod, haddock, hake, cusk, pollock, and rosefish), within quota limitations under the reduced tariff provided under trade agreements, totaled 2,112,009 pounds during June, according to a preliminary report from the Bureau of Customs, Treasury Department.

An analysis of the imports for the first 6 months of 1947, totaling 11,814,937 pounds, when broken down by points of origin, reveals that Canada and Iceland exported to the United States but 45 and 34 percent, respectively, of their shipments for the first 6 months of 1946. Newfoundland, however, during the same period, shipped 94 percent of its 1946 6-month's total.

Country	1947		1946	
	June	6-month Total	June	6-month Total
Canada	1,767,889	8,878,865	3,808,047	19,634,359
Newfoundland	271,050	1,991,600	435,405	2,125,230
Iceland	73,070	944,472	100,000	2,762,844
Norway	-	-	-	1,756
Total	2,112,009	11,814,937	4,343,452	24,524,189

Canada

FISHING INDUSTRY MAKES ADJUSTMENTS: Fishery statistics for the first six months of 1947 indicate that the industry on the Atlantic Coast is definitely adjusting its production and processing program to meet current market requirements, according to the June 1947 issue of Monthly Review of Canadian Fisheries Statistics. The industry enjoyed strong markets for all its products throughout the war years, but as the fisheries of the United Kingdom and North-Western European countries recovered, the European demand has declined, except for certain relief requirements. Markets for frozen fish products have weakened, not only because of the reduced overseas demand, but also due to competition from Newfoundland and Iceland in the United States market.

Since the demand for the canned and salted forms of fish remain relatively strong, both in the normal export markets and for relief purposes, a considerable diversion of production from frozen into cans and salt is evident in the figures for the first six months of 1947. Landings of cod, the principal Atlantic Coast species, amounted to 74,178,000 pounds as compared with 121,758,000 pounds in the same period of 1946. Landings of all species of fish on both coasts amounted to 409 million pounds with a landed value of $17.7 million compared with 434 million pounds valued at $22.6 million in the first six months of 1946. The major decline in landed value has occurred on the Atlantic Coast where the value of the cod and lobster catches was sharply below that of last year. Unfavorable weather conditions were mainly responsible for the reduced lobster catch. The major Pacific Coast fisheries, with the exception of halibut, have not yet come to the season of main production.

No significant changes took place in the prices of fishery products during June, although the index of wholesale prices declined a further 8 points, while the index of prices of all foods increased by 4 points.

The sharp reduction in freezings of cod fillets in 1947 has tended to keep cold-storage holdings of all fish at lower levels compared with those of 1946.

On June 24, Fisheries Minister Bridges announced that up to $8 million would be spent on the purchase of fishery products as part of the Government's policy of providing relief to certain European countries. The Minister indicated that the fish purchases would include up to 10 million pounds of dried salted cod and related species; up to 40,000 barrels of pickled fish; up to 50,000 boxes of bloaters; up to 900,000 cases of West Coast canned herring; and up to 100,000 cases of Eastern canned fish. At the same time, it was announced that the Fisheries Prices Support Act, 1944, would be proclaimed at an early date. It is expected that the relief purchasing program and the operations of the Prices Support Act will provide an opportunity for the industry to maintain a high level of production throughout the current year and to proceed with its adjustment from wartime to peacetime conditions.

* * * * *

THE SALMON PACK IN BRITISH COLUMBIA: The sockeye pack in British Columbia so far this season was good, as a result of a heavy run at Rivers Inlet and Smiths Inlet, according to the July 28 report of the American Consulate General at Vancouver, B. C. However, this is an off-cycle year for sockeye and the total catch for the season will probably be below that of last year, particularly as sockeye fishing in the Fraser River has been closed by the International Sockeye Salmon Commission until early September.

Threat of a British Columbia coast salmon fleet tie-up was averted when fishermen and canners reached agreements for the 1947-48 season. The agreement calls for prices to the fishermen which are slightly higher than last year, the increase being one cent a pound for sockeye, one-half cent for pinks and chums, and one and a half to two cents for coho.

The immediate market outlook insofar as the salmon pack is concerned will depend upon the policy of the Canadian Government. While there have been indications that the Government intends to remove price controls, such orders have not actually been issued as yet. At the same time, the British Food Mission in Canada has not announced or contracted for a definite proportion of this season's salmon pack.

* * * * *

TUNA FISHING IN BRITISH COLUMBIA: Heavy runs of tuna, attributed to exceptionally warm off-shore waters, have been reported off the west coast of Vancouver Island, according to the August 5 report of the American Consulate General at Vancouver. Approximately 15 large Canadian trolling vessels are currently engaged in fishing for tuna, the catch so far this season being estimated at 500,000 pounds.

Although local packers have offered as high as $510 a ton for such fish, the entire catch so far has been sold at a price of $420 a ton, with upward adjustments for the fishermen when complete returns are received, to the Fishermen's

Cooperative Association which is shipping them either in the fresh or frozen state to the United States where they are canned.

Albacore have not been a major source of fishing revenue in British Columbia. Last season, Canadian vessels engaged in tuna fishing operations in many instances did not make expenses and the season was considered a failure. The landed value of such fish in British Columbia in 1943 was $5,760, which increased to $93,373 in 1944. In past seasons, small quantities packed in oil have been canned here in half-pound tins and labeled as tuna.

Norway

HERRING REDUCTION: According to the Royal Norwegian Information Services, a herring reduction company in Bergen, Norway, has dispatched a refrigerator ship to Iceland to carry back to Norway, Icelandic herring for the company's Norwegian herring meal and oil factory. The distance involved is at least 700 miles. There are also reports of a Norwegian plan to equip a floating herring reduction factory for use in the Iceland herring fishery.

PEARL CULTURE

The great advantage to culturing pearls in the Palaus and other places in the ex-mandate was the presence there of the larger black lip pearl oyster, and availability of the gold lip. Because of their larger size, they were not only easier to use as hosts for mother-of-pearl blanks, but also the nacre was laid down at a more rapid rate, so that pearls could be produced in two years rather than in the 3 to 5 required for the native Japanese pearl oyster, Pinctada martensi.

EQUIPMENT FOR PEARL CULTURE

A popular impression exists that a very minute speck of material is used as a base for a cultured pearl. Actually, the blank is practically the size of the finished pearl. Blanks are graduated in size, and because of the thinness of the nacre overlay, a large pearl is produced as rapidly as a smaller one. Equipment, including a slug, for culturing pearls is shown. After the slug is inserted, the oysters are placed in wire baskets holding 10, and are suspended off the bottom in depths from 5 to 25 fathoms.

--Fishery Leaflet 239

FEDERAL LEGISLATION, DECISIONS, ORDERS, ETC.

Department of the Interior

ALASKA SHRIMP CLOSED SEASONS: The following amendment to the Alaska fisheries regulations, signed by Oscar L. Chapman, Acting Secretary of the Interior, became effective on July 31, 1947:

> Commercial fishing for shrimp is prohibited in the periods from February 1 to April 15, from July 15 to July 31, and from August 16 to September 30, all dates inclusive, in the waters of the Stikine District, the Eastern District east of the longitude of Cape Fanshaw, and in the Sumner Strait District north of the latitude and east of the longitude of Point Baker, Provided, That if by reason of the continuing abundance of shrimp in these waters in excess of spawning requirements an additional take may be made in the period from August 16 to September 30, the facts as to the existence of shrimp in such abundance, and the extent of the additional take that may be made in excess of spawning requirements, shall be obtained and recorded by the Director of the Fish and Wildlife Service, or such other person as may be designated by the Secretary of the Interior, and in accordance therewith the limits of the period or periods during which such an additional take may be made from August 16 to September 30 shall be announced by either of them, which announcement shall be final and reasonable notice thereof shall be made public in the Territory of Alaska. All waters of Duncan Canal are closed to shrimp fishing throughout the year.

Department of Agriculture

WFO-63--APPENDIX A, REVISED: The following excerpt is taken from the revision of Appendix A to WFO-63, Part 1596--Food Imports, dated August 8, 1947:

APPENDIX A--ITEMS SUBJECT TO WFO-63

> The numbers listed after the following foods are commodity numbers taken from Schedule A, Statistical Classification of Imports of the Department of Commerce (issue of Sept. 1, 1946). Foods are included in the list to the extent that they are covered by the commodity numbers listed below. If no commodity number is listed, the description given shall control.

Food	Commerce Import Class No.	Governing Date
Fatty acids, not specially provided for, derived from vegetable oils, animal or fish oils, animal fats and greases, not elsewhere specified:		
Cottonseed oil	2260.220	Nov.13,1944
Linseed oil	2260.210	Do.
Soybean oil	2260.230	Do.
Other, not elsewhere specified	2260.240	Do.

This revision shall become effective at 12:01 a.m. EDST, August 9, 1947.

Food and Drug Administration

REDUCTION IN FILL OF CONTAINER FOR CANNED SHRIMP DENIED: An order denying the petition of the shrimp canning industry for a reduction in the fill of container for canned shrimp was signed by Watson B. Miller, Federal Security Administrator, on August 7. Although denying the petition for a change in the existing regulations, the way was left open for a possible change in the future. An opportunity was granted to any interested person whose appearance was filed at the hearing to file objections to the ruling within 20 days from date of its publication in the Federal Register.

Full text of the order, as it appeared in the Federal Register of August 9, follows:

STANDARDS OF FILL OF CONTAINER FOR CANNED SHRIMP

NOTICE OF PROPOSED RULE MAKING

It is proposed that, by virtue of the authority vested in the Federal Security Administrator by the provisions of the Federal Food, Drug, and Cosmetic Act (secs. 401, 701; 52 Stat. 1046, 1055; 21 U. S. C. 341, 371); and on the basis of the evidence received at the above-entitled hearing duly held pursuant to notice issued on June 6, 1947 (12 F. R. 3725-3726), the following order be made:

Findings of fact. 1. By order published in the FEDERAL REGISTER of July 2, 1942 (7 F. R. 4944), standards of fill of container were promulgated for canned wet pack shrimp and canned dry pack shrimp in nontransparent containers. The effective date of the order was August 1, 1942, and since that date nearly all of the canned shrimp in nontransparent containers produced in the United States has been packed in compliance with these standards of fill of container. (R. 10, 91, 100-101; EX. 7) [1]

2. The change from the lower fills which were used prior to the promulgation of these standards of fill of container made it necessary for canners to exercise more careful control at certain stages of the canning process. More care was necessary in packing the shrimp into the cans and additional precautions were necessary to prevent shrimp spilling from cans before sealing. The exercise of these additional precautions placed no unreasonable burden on the canners of shrimp. (R. 15-17, 33, 45, 56-57, 59, 61-62, 77, 115-117, 119-120, 127, 134-135)

3. The probability of an increase in breakage in the closure of cans during and after processing, as a result of compliance with the present requirements, was advanced at the hearing on July 8, 1947, as a reason for reducing the requirement as to fill. The causes of such difficulties are directly related to the structure of the cans used and to lack of proper control of canning operations, particularly the head-space of the can and the temperature of its contents when it is closed. (R. 10-12, 29-30, 35-36, 39-40, 45, 61-62, 65-67, 77, 79-80, 120, 133-124, 141)

4. Canners of shrimp presented at this hearing certain reasons for objecting to the present requirements of fill of container in addition to increased manufacturing difficulties. These included an increased tendency for struvite crystals (referred to in exhibits 3 and 6 as phosphate crystals) to form when canned shrimp is held after canning, lowering of keeping quality caused by the longer time of processing used with the present fill, a tendency for shrimp in some cans to stick together, and an increase in the number of broken and twisted shrimp. (R. 12, 15, 43, 45, 51-52, 61-62, 74-75, 77, 96, 121-122; EXS. 3, 4, 6)

5. For many years it has been observed that small glass-like crystals of the compound struvite (magnesium ammonium phosphate) will develop in an occasional can of shrimp. This is objectionable, since uninformed consumers sometimes mistake the crystals for particles of glass. The cause of the formation of these crystals is not known. There is some indication of an increase in the occurrence of struvite crystals in canned wet pack shrimp after the promulgation of the present standards. No relationship between the incidence of struvite crystals and the drained weight of shrimp has been established. (R. 12-14, 30-32, 37, 45, 52, 67-70, 74-75, 77, 80-81, 82-87, 89, 102-108, 125-126, 139; EXS. 3, 6, 9)

6. Apprehension was expressed that the longer processing time now used would render the shrimp somewhat softer when held for an extended period, unless they were held in cold storage. There is insufficient evidence to show that any increase in softening of shrimp packed under the present standard is of significance to consumers. Nor is the evidence sufficient to show whether the hazards of holding canned shrimp from one season to another have been increased by the longer processing time now employed. (R. 50-52, 58, 64-65, 73-74, 77, 79, 100-101, 122-129, 135-136; EX. 9)

7. Sometimes the shrimp in cans of wet pack shrimp stick together and at times one or more shrimp is broken. This happened to a lesser extent when cans contained less shrimp. No impairment of quality of any significance has resulted from the fill now required. (R. 15, 43, 45, 77, 100-101, 107, 121-122, 124, 127; EX. 9)

8. Sales of canned shrimp have been slow due to high prices. It is the opinion

of many dealers that sales would be facilitated if canned shrimp were available in a smaller quantity than 7 ounces, the weight of shrimp in the No. 1 can wet pack. This was the smallest can permitted until recently under requirements of the wartime tin conservation order. During the last few months some canners have packed shrimp in smaller cans. There was some evidence that certain of these smaller cans are not of a size well adapted to the packing of large and extra large shrimp. However, there is no evidence indicating that there should be established a standard of fill of container for large and extra large shrimp different from the standard of fill of container for medium and small shrimp. (R. 17–25, 45, 49, 77, 93, 99–100, 104, 107, 116–117, 119–120, 131–133; Exs. 4, 8, 9)

Conclusions. On the basis of the foregoing findings of fact it is concluded that:

(a) Reducing the standard of fill of container for wet pack shrimp would result in the replacement of shrimp with brine. The reduction of the standard of fill of container for dry pack shrimp would result in omitting from the can shrimp that could be contained therein. In both instances the size of the cans would inaccurately reflect the amount of shrimp contained therein, particularly because consumers of canned shrimp have been receiving well-filled cans for about five years.

(b) It would not promote honesty and fair dealing in the interest of consumers to reduce the requirements of cut-out weight in the standards of fill of container for canned wet pack shrimp and canned dry pack shrimp in nontransparent containers.

Wherefore, *It is ordered*, That the regulations promulgated July 2, 1942 (7 F.R. 4944), fixing and establishing standards of fill of container for canned wet pack shrimp and canned dry pack shrimp, in nontransparent containers, be not amended to provide for reduction in the requirement for cut-out weight.

Any interested person whose appearance was filed at the hearing may, within 20 days from the date of publication of this order in the Federal Register, file with the Hearing Clerk of the Federal Security Agency, Office of the General Counsel, Room 3255 Federal Security Building, 4th Street and Independence Avenue SW., Washington, D. C., written exceptions thereto. Exceptions shall point out with particularity the alleged errors in the order, and shall contain specific references to the pages of the transcript of the testimony or to the exhibits on which each exception is based. Such exceptions may be accompanied with a memorandum or brief in support thereof. Exceptions and accompanying memoranda or briefs should be submitted in quintuplicate.

Dated: August 7, 1947.

[SEAL] WATSON B. MILLER,
Administrator.

[1] The citations following each finding of fact refer to the pages of the transcript of the testimony and the exhibits received in evidence at the hearing which are the basis for these findings.

Department of Labor

SEAFOOD AND FISHERY EXEMPTIONS: Because of the requirements of the Portal to Portal Pay Act of 1947, the Wage and Hour Administrator issued a new Interpretative Bulletin in July 1947. This bulletin is entitled "General Statement as to the Coverage of the Wage and Hours Provisions of the Fair Labor Standards Act of 1938." It supersedes and replaces all prior general and specific interpretations, specifically those contained in the Interpretative Bulletins Nos. 1, 2, and 5.

Interpretative Bulletin No. 12, entitled "Seafood and Fishery Exemption," is still in effect. Therefore, those firms in the fishery industries which include among their employees, occupations which were not found to be exempt should be acquainted with the new general statement issued by the Wage and Hour Administrator. Copies of the July 1947 bulletin referred to above, which contains the new general statement, may be obtained, upon request, from the Office of the Administrator, Wage and Hour Division, U. S. Department of Labor, Washington 25, D. C.

RECENT FISHERY PUBLICATIONS

Listed below are informational publications which recently have been processed by the Division of Commercial Fisheries. The publications are available, free of charge, from the Fish and Wildlife Service, U. S. Department of the Interior, Washington 25, D. C.

Number	Title
CFS-320	- New England Landings, 1946
FL-239	- Fishery Resources of Micronesia
FL-240	- The Venezuelan Salt-Fish Industries
FL-245	- Balloon Trawl Construction
FL-247	- Fish for Breakfast--and Why Not?
FL-248	- Japanese Whaling in the Bonin Island Area
FL-249	- Natural Resources of Japan
FL-252	- The Decline and Rehabilitation of the Southeastern Alaska Herring Fishery
FL-253	- Manitoba's Fresh Water Fishing Industry

Reprints (Separates) from Commercial Fisheries Review, July 1947.

Sep. No. 178 - Nutritive Value for Growth of Some Fish Proteins
Sep. No. 179 - Fluctuations in Fish Production in the U. S. and Alaska
Sep. No. 180 - Estimations of Extinction Ratios and Vitamin A Potency of 12 Reduction Plant Oils

Designations for fishery publications are interpreted as follows:

CFS - Current fishery statistics of the United States and Alaska.

SL - Statistical lists, consisting of lists of dealers of fishery products and manufacturers of byproducts.

FL - Fishery leaflets.

MDL - Market development lists of frozen food locker plants and locker associations.

Illustrator -- Shirley A. Briggs Compositors -- Jean Zalevsky and Norma C. Dressler

Processing -- Miscellaneous Service Division

METHODS OF NET MENDING--NEW ENGLAND

Net mending has been practiced by fishermen for centuries. There are many known methods of mending nets throughout the world but all are basically similar. This publication describes the methods of net mending as practiced by the New England otter trawl fishermen.

In otter trawl fishing, the crew must mend the nets night and day under the difficult conditions of cramped space, awkward positions, rolling seas, decks awash, rain, snow, and bitter weather. Whenever a tear is found, which usually occurs every time the net is hauled in, it must be mended. Because of these conditions, a mending method suited to trawl fishing has been developed.

Most nets are made by machines, but since the mending of these nets must be done by hand, this probably will remain always a part of the fisherman's work.

MENDING NETS AT SEA

--Fishery Leaflet 241